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TITLE: Laboratories Administration
RELEASE NO.: 042
DATE PREPARED: February 8, 1996

I have entered this release into the document per instructions.

D A Isom 2/20/96
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Paula Noakes T6-03

Implementation Notice
Release #42

Table of Contents

The Table of Contents has been updated to include the following changes.

Chapter 11 Radiological Control

The following sections of this new chapter describe the Analytical Services Occupational ALARA Program. Each section deals with an aspect of the program relating to Analytical Services. Additional sections may be added at a later date.

Section 11.1 "Policy and Management Commitment"

Establishes and defines the management authority and design of the ALARA program at Analytical Services facilities.

Section 11.2 "Assignment of Responsibilities"

Establishes clearly defined responsibilities to implement the ALARA program.

Section 11.3 "Administrative Control Levels"

Establishes administrative control levels to maintain personnel radiation exposure well below regulatory dose limits.

Section 11.4 "Radiological and ALARA Performance Goals/Indicators"

Provides basis for ALARA point-of-contact to prepare calendar year facility or organizational-specific radiological and ALARA performance goals/indicators.

Section 11.5 "ALARA Training"

Identifies the ALARA training requirements for administering and supporting the Analytical Services ALARA program.

Section 11.6 "Plans and Procedures"

Provides instruction on developing an implementation guide and procedures to describe facility/organization specific ALARA programs.

Section 11.7 "Internal ALARA Program Reviews and Work Practice Assessments"

Provides a basis for identifying strengths and weaknesses of ALARA program principle integration into facility ALARA programs.

Implementation Notice
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Section 11.8 "Optimization Methodology"

Documents that optimization methods are used to ensure occupational exposure is maintained ALARA by determining which dose reduction and contamination minimization efforts are reasonable and their costs and benefits.

Section 11.9 "ALARA Design Reviews"

Provides a system to ensure ALARA design principles and criteria are incorporated into facility modifications and new facility designs.

Section 11.10 "ALARA Work Documentation"

Identifies a system to perform formal, documented, and comprehensive radiological ALARA reviews for activities that have potential to exceed approved radiological trigger levels.

Section 11.11 "ALARA Program Records"

Contains requirements for maintaining records relating to ALARA process.

Policy and Management Commitment

Approved by
A. G. King, Manager
Analytical Services

1.0 PURPOSE

The purpose of this section is to establish and define the management authority and discuss the design of the as low as reasonably achievable (ALARA) program at Analytical Services facilities. ALARA is a process for identifying and mitigating radiological hazards, and is measured by reducing personnel radiological exposure and the spread of contamination.

Management support and commitment to reducing individual and collective exposures and controlling radioactive contamination are critical elements in ensuring a successful ALARA program.

Individual involvement is essential to ensure the ALARA philosophy is understood and practiced at all levels of work.

The ALARA Program incorporates guidance found in Title 10, Code of Federal Regulations (CFR), Part 835, *Occupational Radiation Protection, Subpart B, Radiation Protection Programs*, Article 835.101(c) and G-10 CFR 835/B2, Rev. 1, "Implementation Guide for Use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection."

2.0 SCOPE

The ALARA policy and program requirements apply to all personnel who plan, prepare, or perform radiological work. Personnel who perform support functions (e.g., training, engineering, design) need to be informed of the ALARA policies and philosophies to the extent that their work affects or influences radiological work being planned, prepared, or performed.

3.0 DEFINITION

As Low As Reasonably Achievable (ALARA)

The approach to radiation protection is to maintain and control individual and collective exposures to the workforce and general public to levels as low as is reasonable. This approach considers social, technical, economic, practical, and public policy needs. ALARA is not a dose limit, it is a process to achieve and maintain dose and contamination reduction within acceptable limits and as far below these limits as is reasonably achievable.

4.0 RESPONSIBILITIES

4.1 Management and Employee Commitment

Senior and Line Management	1.	Should demonstrate their support of the ALARA Program by regularly affirming this commitment to all plant personnel. They may do this by ensuring that all plant personnel understand their responsibility to comply with the ALARA Program.
	2.	Should demonstrate their support of the program through direct instruction, communication, and inspection of the work place.
Management	3.	Should reinforce commitment to ALARA and exposure reduction by integrating it into radiological work planning, preparation, and performance.
	4.	Should document management's commitment to the ALARA policy within the facility by continuously applying and integrating the ALARA process into work tasks.
All Employees	5.	Should demonstrate responsibility and accountability through an informed, disciplined, and cautious attitude toward radioactivity and radiological work.
	6.	Should recognize that their actions directly affect contamination control, personnel radiation exposure, and the overall radiological environment associated with their work.

5.0 RECORDS

Any records generated as a result of this activity will be handled in accordance with applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance and Support (Champion)	T6-14
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28
Building Operations	T6-22
Laboratory Engineering	T6-12
Maintenance and Work Control	T6-14
Characterization Project Radiological Control	S7-81

7.0 REFERENCE

10 CFR 835, 1993, "Occupational Radiation Protection, Subpart B, Radiation Protection Programs", *Code of Federal Regulations,* as amended.

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Assignment of Responsibilities

Approved by

A. G. King, Manager
Analytical Services 12/22/95

1.0 PURPOSE

To ensure that clearly defined responsibilities are established by management to implement the as low as reasonably achievable (ALARA) program.

2.0 SCOPE

This procedure defines facility/organization responsibilities required for the effective application and implementation of the ALARA philosophy and process in the field. The coordination of numerous support and functional groups is necessary at each level to accomplish this result. The responsibilities of all the various personnel involved in the ALARA Program should be well defined and documented.

3.0 DEFINITIONS

ALARA Council

A multi-disciplined committee comprised of the ALARA Program Office (APO), facility, project, or organizational ALARA committee chairpersons or point-of-contacts (POC), and ALARA Council support personnel.

ALARA Point-of-Contact (POC)

An individual responsible for coordinating development, implementation, and documentation of the organizational specific ALARA Program.

Analytical Services ALARA Committee

A multi-disciplined committee comprised of the RADCON Team, ALARA point-of-contact (POC), Laboratory Engineering and Radiological Control.

Cognizant (Cog) Engineer

The engineer assigned complete technical responsibility for design, procurement, fabrication, installation, preventative maintenance, removal, or modification of structure, systems,or components, as well as responsibility for evaluating the adequacy of spares and maintenance.

CCIP

A Radiological Control program integrated with the WHC ALARA Program, which provides a central focal point in the site-wide effort to improve contamination control practices. CCIP tracks occupational and environmental contamination, develops associated performance indicators, provides planning and technical support for contaminated area reduction efforts, and performs assessments regarding radiological work practices.

Collective Dose
The sum of the total effective dose equivalent values for all individuals in a specified population. Collective dose is expressed in units of person-rem.

Person-in-Charge (PIC)
A qualified individual assigned responsibility for coordinating, directing, and monitoring the performance of a work package.

RADCON Team
The RADCON Team is a multi-disciplined team comprised of a mixture of line management, workers and professional employees from various organizational entities.

Work Control
The organization which ensures the proper maintenance of Analytical Services facilities through implementation of the Job Control Program.

4.0 RESPONSIBILITIES

4.1 Employees

1. Apply ALARA principles and practices in all aspects of work.

2. Notify management of hazardous conditions, practices, or substances that are contrary to ALARA practices and philosophy.

3. Provide improvement suggestions with respect to ALARA for the work area to their RADCON Team or ALARA POC.

4.2 Analytical Services Manager

1. Designate an ALARA POC and provide that person with the full authority to implement the ALARA Program requirements within their area of responsibility.

2. Review and approve annual facility ALARA goals with respect to scope and funding.

3. Review and approve quarterly ALARA goal status reporting. (See Section 4.)

4. Promote and support an ALARA philosophy regarding exposure reduction and contamination control in all facets of the organization.

4.3 ALARA Committee

1. Evaluate the following for contamination, exposure, waste, and release minimization/optimization:

   - Construction and design of facilities and systems
   - Planned major modifications or work activities
   - Experimental test plans
   - Activities that meet ALARA review trigger level criteria.

4.4 ALARA Point-of-Contact

1. Coordinate the administration of the facility specific ALARA Program.

2. Establish a multi-disciplined, facility specific ALARA Committee to support development and administration of the specific ALARA Program.

3. Participate in the monthly site-wide ALARA Council meetings and agenda.

4. Develop a procedure that clearly defines responsibilities to implement the ALARA Program requirements within the daily operation of the facility, project, or organization. (See Section 6.)

5. Develop annual facility ALARA performance goals and provide formal status reporting. (See Section 4.)

6. Perform post job reviews on all completed work packages which required an ALARA Management Worksheet (AMW). (See Section 10, Step 10.4.5.)

7. Review facility administrative control levels annually. (See Section 3, Step 3.4.1.)

8. Administer an investigative process to assess exposure anomalies. (See Section 3, Step 3.4.4.)

4.5 Cog Engineer

1. Prepare AMWs on an as requested basis. (See Section 10, Step 10.4.2.)

2. Conduct formal radiological post ALARA reviews, as applicable. (See Section 10, Step 10.4.6.)

3. Initiate and support the ALARA design review process. (See Section 9.)

4.6 Person-in-Charge (PIC)

1. Conduct an ALARA pre-job meeting as requested. (See Section 10, Step 10.4.3.)

2. Conduct periodic field inspections. (See Section 10, Step 10.4.4.)

4.7 RADCON Team

1. Provide recommendations to management to improve progress toward minimization of radiation doses and radioactive material releases.

2. Provide a mechanism for employees to submit ALARA concerns and suggestions.

3. Conduct, at a minimum, monthly team meetings and issue meeting minutes describing issues and topics discussed at that meeting.

4.8 Radiological Control

1. Provide the focal point and interface in the facility for the CCIP. Promote contaminated area reduction and provide required status updates.

2. Facilitate assigned reviews and assessments, as required, within the timeframe and in accordance with Section 7.

3. Support the ALARA design review process. (See Section 9.)

4. Prepare Radiological Work Permits upon request. (See Section 10, Step 10.4.1.)

4.9 Work Control

1. Support the ALARA work documentation process. (See Section 10, Steps 10.4.1 and 10.4.5.)

5.0 RECORDS

Any records generated as a result of this activity will be handled in accordance with applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance & Support (Champion)	T6-16
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28

Administrative Control Levels

Approved by
A. G. King, Manager
Analytical Services
12/22/95

1.0 PURPOSE

The U.S. Department of Energy (DOE) and Westinghouse Hanford Company (WHC) ALARA Program objective is to maintain personnel radiation exposure well below regulatory dose limits. To accomplish this objective, challenging numerical administrative control levels are established at levels below the regulatory limits to administratively control individual and collective radiation dose. Multi-tiered control levels with increasing levels of authority are required for personnel to be approved for a higher administrative control level.

2.0 SCOPE

This section applies to the analytical laboratories under jurisdiction of WHC. Detailed information relating to the specific numerical Administrative Control Levels is provided in the *Hanford Site Radiological Control Manual* (HSRCM-1), Chapter 2, and DOE/EH-0256T, *Radiological Control Manual*, Article 211. WHC specific guidance is provided in WHC-CM-4-14, *Radiological Control Practices Manual*. Specific guidelines for the control of emergency exposures to radiation are not discussed in this section.

3.0 DEFINITION

Administrative Control Level
A numerical dose constraint established at a level below the regulatory limit to administratively control and help reduce individual and collective radiation exposure.

4.0 RESPONSIBILITIES

4.1 Annual Administrative Control Levels

1. Analytical Services utilizes the WHC administrative control levels as specified in the Table H2-1, HSRCM-1. These control levels are depicted in Table 3-1.

2. The ALARA point-of-contact shall review administrative control levels annually and revise as necessary to reflect any changes in WHC policy (HSRCM-1, Article 211.2).

4.2 Administrative Control Level Change Authorization

1. Line Management is required to provide special approval before an individual exceeds an administrative control level.

2. Radiological Worker administrative exposure controls require increasing degrees of review, intervention, and management approval before they are exceeded.

4.3 Training on Administrative Control Levels

Line Management
1. Line Management must ensure proper implementation of the administrative control levels.

ALARA POC
2. Ensure workers are fully informed of the applicable administrative control levels to prevent personnel from exceeding limits and aid in attaining occupational exposures ALARA.

NOTE: A required reading document will be distributed yearly to advise personnel of the administrative levels.

4.4 ALARA Exposure Tracking and Management System

1. ALARA point-of-contact administers an investigative process to assess all exposure anomalies, with the exception of those which have been identified as having received finger ring dose that is high compared to deep dose. Laboratories are designed and operated to have a high finger ring to deep dose ratio.

2. Investigate and document the results by using a form similar to Appendix A.

3. Ensure an exposure investigation is completed and distributed to the ALARA Program Office, accompanied by a numbered internal memorandum to document the facility completing the investigation.

4. Ensure employees identified as having exposure anomalies are notified of the anomaly in a timely manner.

5.0 RECORDS

Any records generated as a result of this activity will be handled in accordance with applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance & Support (Champion)	T6-14
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28

7.0 REFERENCES

HSRCM-1, *Hanford Site Radiological Control Manual*, Pacific Northwest Laboratories, Richland, Washington.

DOE/EH-0256T, *Radiological Control Manual*.

WHC-CM-4-14, *Radiological Control Practices Manual*.

Table 3-1

Administrative Control Levels

Maximum Dose Equivalent (Annual), mrem				
TEDE	Skin and Extremity[c]	Lens of Eye[c]	Any Organ[c]	Approval Required to Exceed This Level[a]
500	15,000	4,500	15,000	Level 3 line manager & RCM[b]
1,000	22,500	6,750	22,500	Level 2 line manager & RCM
1,500	30,000	9,000	30,000	Contractor senior site executive
2,000				DOE PSO[d]
Age x 1,000 = lifetime total effective dose equivalent (TEDE)				Level 1 line manager & RCM

(a) Approvals are sequential.
(b) RCM = Radiological Control Manager; approval may be delegated within the Radiological Control Organization.
(c) The values are based on the nonstochastic limit and are calculated as committed doses.
(d) PSO = Program Secretarial Officer.

Appendix A

Investigative Dose Anomaly Results

Manager	Anomaly Class	Explanation	ALARA Controls in Place

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Radiological and ALARA Performance Goals/Indicators

Approved by
A. G. King, Manager
Analytical Services

1.0 PURPOSE

To provide a basis for the ALARA Point-of-Contact (POC) to prepare calendar year (CY) facility or organizational-specific radiological and ALARA performance goals/indicators.

2.0 SCOPE

This procedure applies to the establishment of calendar year facility and/or organizational radiological and ALARA performance goals/indicators.

3.0 DEFINITION

Facility and/or Organizational Specific ALARA Goals/Indicators
Goals established at the facility and/or organizational level to represent the specific needs and ALARA applications of that particular facility or facilities.

4.0 RESPONSIBILITIES

4.1 Radiological and ALARA Performance Goals/Indicators

Facility/Org Manager

1. Participate in establishing radiological and ALARA performance goals/indicators annually to focus and direct the attention of all levels of employees toward areas of performance requiring improvement.

2. Review radiological and ALARA performance goals/indicators on a quarterly basis.

4. Examples of typical quantitative performance indicators for an ALARA program include the following, as applicable:

   - Annual collective dose for the facility
   - Annual collective dose for the major departments involved in radiological work
   - Average worker dose
   - Maximum dose to a worker

- Number of unplanned exposures resulting in doses greater than the administrative control levels
- Number of skin and personal clothing contaminations (per man-hour worked in radiological areas, if available, to facilitate comparisons)
- Numbers of incidents of area contamination outside of controlled areas
- Area of the facility that is contaminated in square meters. (Also, the percentage of the controlled area that is contaminated, and is to be reduced in severity.)
- Volume and activity of radioactive waste generated in cubic meters and curies, respectively.
- Number of radiological occurrences requiring reporting per DOE 232.1 reporting criteria.

4.2 Establishing and Setting Facility and Organizational-Specific Radiological and ALARA Performance Goals

Facility Management	1.	Determine, with assistance from the facility ALARA POC and RADCON Team, which dose reduction and contamination minimization efforts should be prioritized based on ALARA considerations.
General Employee	2.	Evaluate identified deficiencies, determine the improvement needed, and propose the goal.
ALARA POC	3.	Present the goal to facility management, or their designee, for approval.
Facility Management	4.	Assign the responsibility for completing identified goals to the appropriate department head, manager, or Team Leader to develop and implement action plans.
ALARA POC	5.	Review performance in achieving the goal at an established frequency.

4.3 Revising Facility and Organizational-Specific Radiological and ALARA Performance Goals

ALARA POC	1.	Revise goals only when there is a significant change in the technical basis, or assumption, used to establish the goal (e.g., work scope).
	2.	Present revisions of facility/organization specific goals to facility/organization management for approval, as applicable.

4.4 Reporting Facility and Organizational-Specific Radiological and ALARA Performance Goals/Indicators

ALARA POC
1. Document the ALARA performance goals and their status, and the facility's and organization's performance every three months. Provide the APO with this status using the ALARA goal reporting format outlined in Appendix A.

2. Submit annual draft goals to the APO for review as scheduled in Table 4-1.

Facility Management
3. Sign and approve the final annual goal submittal. Final goals should be submitted to the APO as scheduled in Table 4-1.

ALARA POC
4. Provide facility and organizational ALARA goal status every three months as scheduled in Table 4-1, using the format provided in Appendix A.

NOTE: ALARA goals are available for viewing on the Lab Procedures Drive, "RAD-CONT.ROL" directory.

5.0 RECORDS

Any records generated by this activity will be handled in accordance with the applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance & Support (Champion)	T6-14
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28

7.0 REFERENCES

DOE 232.1, 1995, *Occurrence Reporting and Processing of Operations Information.*

Table 4-1

ALARA Goal Report Schedule

Action	Month Due to APO
I. Quarterly ALARA Goals Status[a]	
First quarter	May
Second quarter	August
Third quarter	November
Calendar year final status	February
II. Annual CY ALARA Goals Submittal[a]	
Draft	September
Final	October

[a]All due dates are the fifteenth day of the identified month.

APPENDIX A

(Insert Facility/Organization name) ALARA GOALS
(First, Second, Third) QUARTER STATUS (or) YEAR END STATUS

Goals Open	#
Goals Completed	#
Goals Revised	#
Goals Canceled	#
Goals Added	#
Total Goals	#

I. Scope - (Make a brief statement that identifies the facilities' current function. Any additional information that could assist a person unfamiliar with the facility, and to better understand the ALARA goals, is relative to this section and should be included.)

II. Exposure Reduction and Control Goals (List qualitative goals related to the performing ALARA.)

1. (List ALARA goal)

STATUS: Open - (Indicates the goal requires further action to complete. State what steps have been taken and what is required to complete the goal.)

Completed - (Indicates no further action is required.)

Revised - (Indicates significant change in basic assumption used to establish goal. Revise the goal using the original number followed by a lower case "a". State the reason for revising the goal.)

Canceled - (Indicates that this goal cannot be accomplished. State the reason for canceling this goal.)

ECD: (State the Estimated Completion Date of the goal.)

ANALYSIS OF PERFORMANCE AND LESSONS LEARNED: (Discuss the methodology used in achieving this goal, any lessons learned, and estimate the collective dose saved, as applicable, as a result of this goal.)

NOTE: Additional ALARA goals should be listed based on activities and work scope of each facility/organization. Goals should be numbered consecutively.

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ALARA Training

Approved by
A. G. King, Manager
Analytical Services

1.0 PURPOSE

This procedure identifies the ALARA training requirements necessary for administering and supporting the Analytical Services ALARA Program.

2.0 SCOPE

To identify the ALARA training requirements for personnel responsible for implementing and/or supporting the ALARA Program. This includes personnel who are responsible for planning, preparing, performing, and managing radiological work at WHC.

NOTE: ALARA Training, and subsequent requirements can be met as part of currently established courses; e.g., Hanford General Employee Training (HGET), Rad Worker I, Rad Worker II, and Radiological Control Technician (RCT).

3.0 DEFINITION

Specialized Radiological Worker
An individual whose work assignment includes work in nonroutine operations or work in areas with changing radiological conditions.

4.0 RESPONSIBILITIES

4.1 ALARA Training

General Employees

1. Shall be trained in radiation safety before receiving occupational exposure during access to controlled areas. The training frequency shall be consistent with requirements of DOE/EH-0258T-1, and retraining shall be conducted at intervals not to exceed 2 years. Training should contain orientation on the ALARA policy and philosophy and an explanation of its biological basis. [§835.901(a,b)]

Radiological Workers

2. Shall attend training and retraining programs at intervals not to exceed two years. The training should contain the following:

   - Fundamentals of radiation protection
   - Fundamentals of the ALARA process

- Site and organizational ALARA policy
- Basic ALARA protective measures (time, distance, shielding, and reduction of radioactive materials)
- General methods and uses of ventilation, filtration, and containment
- Radiation workers responsibilities to reduce their exposure and the spread of radioactive material
- Procedures to control dose and contamination of radioactive materials that are specific for the type of work
- Significant changes to the occupational ALARA Program
- Lessons learned from radiological occurrences, as applicable (DOE/EH-0256T, Articles 631, 632, and 633).

Specialized Radiological Workers

3. Shall attend specialized radiological worker training, which is required in addition to Rad Worker II for personnel who plan, prepare, and perform jobs that meet the following criteria (HSRCM-1, Article 634):

- Are nonroutine operations
- Work in areas with changing radiological conditions
- Have a potential for high radiological consequences.

Such jobs may involve special containment devices, the use of mockups, and ALARA considerations and controls.

Radiological Control Technicians

4. Should ensure they are knowledgeable of the requirements and trained to manage their own exposure and the exposure of workers under their concern. This applied training for various ALARA assignments should be directly supervised by a qualified person. They shall attend RCT training, [§835.903], which should include site-specific classroom and hands-on training in the following areas:

- Procedures for attaining and maintaining exposures ALARA
- Organizational and site ALARA policy
- Organizational and site ALARA philosophy
- Site ALARA organization
- Their responsibility for ALARA performance goals
- Advanced protective measures used at the Hanford Site

- Responsibilities of RCTs in implementing the Hanford Site ALARA Program
- Exposure and contamination controls established for Hanford Site-specific repetitive activities
- Proper documentation of the Hanford Site ALARA records
- Lessons learned from radiological occurrences, as applicable (DOE/EH-0256T, Article 642).

NOTE: Frequency of retraining shall be consistent with DOE/EH-0262T-1.

Technical/ Radiological Support Personnel

5. To ensure effective participation in implementing the ALARA Program technical and radiological support personnel (e.g., engineers, planners, schedulers, procedure writers) should be trained in the following areas:

- ALARA principles
- Basic ALARA techniques
- Dose reduction and contamination control techniques.

They should also participate in selected portions of job-specific and specialized training and mock-ups (DOE/EH-0256T, Articles 652 through 657).

They should be trained to the level of the workers for whom they plan and prepare radiological work.

4.2 ALARA Training Records

ALARA training records shall be maintained by the Hanford Training Center. The training records should include documentation on training lesson plans, attendance records, and examinations given to participants during training activities. (HSRCM-1, Article 742)

For information relating to other ALARA records, see Section 11.

5.0 RECORDS

Any records generated by this activity will be handled in accordance with the applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance & Support (Champion)	T6-14
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28

7.0 REFERENCES

HSRCM-1, *Hanford Site Radiological Control Manual*, Pacific Northwest Laboratories, Richland, Washington.

DOE/EH-0256T, *Radiological Control Manual.*

DOE/EH-0258T-1, 1992, *General Employee Radiological Training and Radiological Worker Training, Program Management Manual.*

DOE/EH-0262T-1, 1992, *Radiological Control Technician, Training Program Management Manual.*

Plans and Procedures

Approved by

A. G. King, Manager
Analytical Services

1.0 PURPOSE

To develop a facility/organization specific program that consists of the appropriate plans, procedures, instructions, and reviews for applying the ALARA process to occupational exposures. The program shall be commensurate with the nature of the activities performed at each facility. [Section 835.101(c)]

2.0 SCOPE

This procedure provides instruction on developing an implementation guide and supporting procedures to describe the organization, responsibilities, and method of operation of a facility/organization specific ALARA program.

3.0 DEFINITION

Facility/Organizational Specific ALARA Implementation Guide

A facility/organization specific procedure to establish organizational, administrative, and individual responsibilities for compliance with the requirements of the WHC ALARA Program as it applies to the facility.

4.0 RESPONSIBILITIES

4.1 Facility/Organizational Specific ALARA Implementation Guide

NOTE: The following elements will be addressed in the implementation guide. The facility/organization manager and ALARA Point-of-Contact (POC) have responsibility for ensuring these elements are adequately addressed.

ALARA POC

1. Establish an administrative procedure to define the organization, administration, membership, and responsibilities of the ALARA Program.

2. Define the methodology, from inception to record retention, for accomplishing each of the following ALARA processes within the facility:

   - Radiation Work Permits (and/or alternate formal mechanism)
   - ALARA Management Worksheets
   - Exposure Review of Work in Progress

- Post ALARA Reviews
- ALARA Design Reviews
- Cost/Benefit Analysis
- Pre-Job Briefs.

3. Define the facility/organization specific ALARA training requirements, per Section 5.

4. Administer the facility/organization specific ALARA goal setting, tracking, reporting, and evaluation process.

5. Administer a personnel dose tracking program to manage employees' exposure within the administrative control levels (see Section 3).

6. Administer a facility/organization specific ALARA suggestions program to address identification of problems or improvements and provide resolution and follow-up.

7. Outline, for the purpose of developing facility/organization specific lessons learned, the ALARA Committee review process for the following, as appropriate:

   - Internal Program Reviews/Work Practice Assessments
   - Post ALARA Reviews
   - Radiological Occurrence Reports
   - Exposure Tracking and Management Investigations

8. Administer a facility/organization specific ALARA suggestions program to address identification of problems or improvements, provide resolution and follow-up, and deliver incentives for participation.

9. Administer the self-assessment program to evaluate the administration of the facility/organization specific program and the ALARA work practices in the field (see Section 7).

10. Identify a mechanism to track and manage corrective action items associated with ALARA Program reviews, and work practice assessments.

4.2 Work Management System

Facility/Org Manager	1.	Ensure a facility/organization specific system is in place for the appropriate radiological control personnel and/or ALARA POC to review maintenance and modification work documents to ensure adequate radiological requirements and controls have been identified and incorporated; e.g., engineering controls to reduce dose and the spread of contamination.

5.0 RECORDS

Any records generated as a result of this activity will be handled in accordance with applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance & Support (Champion)	T6-14
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28

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Internal ALARA Program Reviews and Work Practice Assessments

Approved by

12/21/95

A. G. King, Manager
Analytical Services

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1.0 PURPOSE

To provide a basis for facility/line management and ALARA Committee entities to identify the strengths and weaknesses of integrating ALARA program principles into the performance of their ALARA Program. To assist in determining compliance with DOE ALARA policy and confirm that techniques are being used in controlling work related exposures to radiation at levels that are ALARA. These reviews and assessments also assist in determining what corrective actions are required to improve the effectiveness of the ALARA Program.

2.0 SCOPE

These ALARA reviews and work practice assessments apply to all facilities/organizations that have an established ALARA Point-of-Contact (POC) or Committee and use, handle, or work with hazardous and/or radioactive materials.

3.0 DEFINITIONS

ALARA Program Assessment of Radiological Work Practices
A periodic assessment, or observation, of radiological work areas and work in progress of the completeness and execution of applying ALARA optimization techniques in the field.

Internal ALARA Program Review
An internal review, assessment, or evaluation of the ALARA program, designed to ensure that the program effectively complies with federal and management requirements, as well as with appropriate good practices.

4.0 RESPONSIBILITIES

4.1 ALARA Work Practice Assessment

Assigned RC Representative	1. Schedule and meet with the facility ALARA POC to review facility protocol and perform assessment.
	2. Prepare a summary report of assessment observations and/ or findings and transmit a copy to the facility manager, manager Operations Assurance and Support, ALARA POC and the APO.
	3. Meet and discuss the program assessment findings and any recommended corrective actions with the assessed organization(s) management and ALARA POC.
OAS	4. Input any unresolved observations and/or findings into the Hanford Action Tracking System.

4.2 Internal ALARA Program Reviews

Facility and ESQ/RC managers

1. Ensure that internal ALARA program reviews of all ALARA elements within the radiation protection program are conducted no less frequently than every three years.

2. Ensure the internal ALARA Program reviews include radiation protection and ALARA program content and implementation.

3. Verify these reviews follow the guidelines in DOE Order 5482.1B.

4. Ensure management's responsibilities for reviewing, auditing, assessing, and evaluating the ALARA program are clearly documented.

Facility Mgr./ ALARA POC

5. Assign an evaluator or team, to conduct the Internal ALARA Program Reviews (IAPR).

Evaluator(s)

6. Use the IAPR Datasheet to document the review (Example Figure 7-1). The review process should include information covering the following:

   - Organizational and management performance
   - Administrative performance
   - Radiological ALARA performance goals/indicators
   - Conduct of operations
   - Records and documentation.

7. Prepare a summary report of program review observations and/or findings and transmit a copy to the facility manager, manager Operations Assurance and Support (OAS), ALARA POC and the APO.

8. Meet and discuss the program assessment findings and any recommended corrective actions with the assessed organization(s) management and ALARA POC.

OAS

9. Input any unresolved observations and/or findings into the Hanford Action Tracking System.

4.3 ALARA Work Practice Assessment and Internal Program Review Guidelines

Guidelines include the following, but are not limited to:

- Provide a list of positive features and specific examples of good work practices observed during the assessment.

- Review previous assessments performed in the assigned areas (if any) for outstanding findings and required corrective actions. Review RPRs issued since last assessment and look for trends.

- Evaluate the scope of assessment and internal review criteria for applicability. Submit suggested changes to the APO, as necessary.
- Review any facility-specific requirements or controlling documents (e.g., RWPs, AMWs, work procedures, access requirements).
- Notify the responsible individuals (e.g., supervisors, custodians) of the date and time of the assessment.
- Conduct the assessment with as little interference to ongoing activities as possible.
- Identify deficiencies to help the organization respond with appropriate corrective actions, if needed. Be concise when describing the deficiencies.
- Identify any corrective action(s) that should be corrected immediately.
- Recommend any actions required to prevent a recurrence of identified deficiencies.

5.0 RECORDS

Any records generated as a result of this activity will be handled in accordance with applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance & Support (Champion)	T6-14
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28

7.0 REFERENCES

DOE Order 5482.1B, 1990, *Environment, Safety and Health Appraisal Program*

Figure 7-1. Example of WHC Internal Program Review. (sheet 1 of 10)

It is necessary to periodically review and evaluate the implementation and effectiveness of ALARA programs to ensure that objectives are being satisfactorily met. Applicability of the ALARA program includes evaluation of whether the program is relevant to current operations and needs. As workloads and functions change, so may the means of achieving ALARA objectives.

The Internal ALARA Program Review evaluations, along with the feedback, provide a basis for management to develop or change objectives to improve support for the ongoing implementation of the ALARA program. The reviews also assist in determining what areas may need the most attention due to recent policy or procedure changes.

The elements listed for this review should be examined for trends so that corrective actions can be taken as necessary. Feedback can be either positive or negative, and will be provided to management to verify achievement of ALARA objectives, or call attention to problems to initiate corrective action.

Status ranking is provided for subjectively evaluating the performance of each element using the following approach:

Excellent	4	Completely satisfies criteria
Satisfactory	3	Meets most major aspects of the criteria
Poor	2	Satisfies some of the criteria, but omits some major aspects
Unsatisfactory	1	Does not meet criteria

A summary of the extent of compliance, or noncompliance, should be included for each element listed. Corrective actions are required to be included for each status ranking element of 2 or less.

Reviews are to be completed and returned to the APO.

Facility/Organizational ALARA Committee Assessed: _____

Date of Assessment: _____/_____/_____

ALARA Chairperson or Designee, Signature: _____

Figure 7-1. Example of WHC Internal Program Review. (sheet 2 of 10)

INTERNAL ALARA PROGRAM REVIEW

	A. POLICY AND MANAGEMENT COMMITMENT	Status Ranking
1.	Has an ALARA Committee chairperson been identified and designated to perform the duties outlined in WHC-IP-1043, Section 2?	
	Extent of compliance/noncompliance:	1 2 3 4
2.	Is a multi-disciplined ALARA Committee established for your facility or organization that consists of a good cross section of representatives using "hands-on" personnel?	
	Extent of compliance/noncompliance:	1 2 3 4
3.	Does the facility manager routinely attend facility ALARA committee meetings to provide input and feedback?	
	Extent of compliance/noncompliance:	1 2 3 4
4.	Does the facility or organizational ALARA Committee chairperson attend Westinghouse Hanford Company ALARA Council meetings?	
	Extent of compliance/noncompliance:	1 2 3 4
5.	Are regular ALARA Committee meetings conducted within your facility or organization?	
	Extent of compliance/noncompliance:	1 2 3 4
6.	Does the ALARA Committee chairperson meet regularly with the facility or organizational manager to status the effectiveness of implementing the facility or organizational ALARA Program?	
	Extent of compliance/noncompliance:	1 2 3 4

Figure 7-1. Example of WHC Internal Program Review. (sheet 3 of 10)

	B. ASSIGNMENT OF RESPONSIBILITIES	Status Ranking
1.	Are clearly defined responsibilities established to implement the ALARA Program at the facility or organization?	
	Extent of compliance/noncompliance:	1 2 3 4
2.	Are the responsibilities of all the various personnel involved in the program well defined and documented?	
	Extent of compliance/noncompliance:	1 2 3 4

	C. ADMINISTRATIVE CONTROL LEVELS	
1.	Does the ALARA Committee actively review and provide timely responses to the "ALARA Dose Tracking and Management Program" investigation reports for the facility or organization, as applicable?	
	Extent of compliance/noncompliance:	1 2 3 4
2.	Are exposure trends reviewed on an established frequency for inputing ALARA considerations?	
	Extent of compliance/noncompliance:	1 2 3 4

	D. ALARA PERFORMANCE GOALS	
1.	Have measurable and realistic ALARA goals been established for the facility or organization?	
	Extent of compliance/noncompliance:	1 2 3 4

Figure 7-1. Example of WHC Internal Program Review. (sheet 4 of 10)

	D. ALARA PERFORMANCE GOALS (CONT.)	Status Ranking
2.	Have goals been established for all the specific areas identified in WHC-IP-1043, Section 4?	
	Extent of compliance/noncompliance:	1 2 3 4
3.	Does upper management, with assistance from the ALARA Committee, decide which dose reduction efforts should be prioritized based on ALARA considerations and establish goals for these?	
	Extent of compliance/noncompliance:	1 2 3 4
4.	Have ALARA goals been established relative to personnel exposure and skin contaminations for the facility/organization?	
	Extent of compliance/noncompliance:	1 2 3 4
5.	Have collective radiological exposure goals for individual work groups and the facility been established? Are they routinely tracked?	
	Extent of compliance/noncompliance:	1 2 3 4
6.	Does line management or designee present the goals to upper management for approval?	
	Extent of compliance/noncompliance:	1 2 3 4
7.	Does upper management assign responsibility for the goals?	
	Extent of compliance/noncompliance:	1 2 3 4
8.	Are action plans developed to implement and complete the goals?	
	Extent of compliance/noncompliance:	1 2 3 4
9.	Does upper management review the performance in achieving the goals at an established frequency?	
	Extent of compliance/noncompliance:	1 2 3 4

Figure 7-1. Example of WHC Internal Program Review. (sheet 5 of 10)

	D. ALARA PERFORMANCE GOALS (CONT.)	Status Ranking
10.	Are quarterly updates of ALARA goals being performed using verifiable data?	
	Extent of compliance/noncompliance:	1 2 3 4
	E. ALARA TRAINING	
1.	Is specific ALARA training and retraining conducted at an appropriate frequency to ensure effective participation in implementing the ALARA Program?	
	Extent of compliance/noncompliance:	1 2 3 4
2.	Are support personnel who are responsible for implementing the ALARA Program receiving and attending ALARA training?	
	Extent of compliance/noncompliance:	1 2 3 4
3.	Are appropriate ALARA training records maintained, as necessary, to demonstrate compliance?	
	Extent of compliance/noncompliance:	1 2 3 4
	F. PLANS AND PROCEDURES	
1.	Has an implementing procedure been established to factor the ALARA Program requirements into facility or organizational procedures (e.g, administrative procedure)?	
	Extent of compliance/noncompliance:	1 2 3 4
2.	Is the method of operation of the Facility ALARA Program described?	
	Extent of compliance/noncompliance:	1 2 3 4

Figure 7-1. Example of WHC Internal Program Review. (sheet 6 of 10)

	F. PLANS AND PROCEDURES (CONT.)	Status Ranking
3.	Are operating procedures for activities with the potential for significant exposure rates and potential to spread radioactive material reviewed on an established frequency for inputing ALARA considerations?	
	Extent of compliance/noncompliance:	1 2 3 4
4.	Do activities that meet ALARA Review trigger level criteria have an AMW completed?	
	Extent of compliance/noncompliance:	1 2 3 4
5.	Are ALARA reviews being performed commensurate with the nature of the activities being performed?	
	Extent of compliance/noncompliance:	1 2 3 4
	G. INTERNAL REVIEWS/WORK PRACTICE ASSESSMENTS	
1.	Are Internal ALARA Program Reviews and Work Practice Assessments conducted on all functional elements of the ALARA Program, including program content and implementation, at a set frequency?	
	Extent of compliance/noncompliance:	1 2 3 4
2.	Do Internal Program Reviews and Work Practice Assessments include evaluations by an individual or members of the facility who have no direct responsibility for implementing the program?	
	Extent of compliance/noncompliance:	1 2 3 4
3.	Are findings of Internal ALARA Program Reviews, Work Practice Assessments, and the proposed corrective actions reported to individuals in the highest level of the organization by the ALARA Committee?	
	Extent of compliance/noncompliance:	1 2 3 4

Figure 7-1. Example of WHC Internal Program Review. (sheet 7 of 10)

	H. OPTIMIZATION METHODOLOGY	Status Ranking
1.	Are optimization methods used to ensure that occupational exposure is maintained ALARA in developing and justifying facility design and modifications, as appropriate?	
	Extent of compliance/noncompliance:	1 2 3 4
2.	Is the level of effort involved in documenting ALARA decisions commensurate with the costs and potential dose savings to be realized?	
	Extent of compliance/noncompliance:	1 2 3 4
3.	Are the associated optimization records maintained, as appropriate?	
	Extent of compliance/noncompliance:	1 2 3 4

	I. ALARA DESIGN REVIEWS	
1.	Are design features and administrative controls used for facilities and equipment to keep radiation exposures in controlled areas ALARA?	
	Extent of compliance/noncompliance:	1 2 3 4
2.	Are ALARA design criteria and practices incorporated into work planning as early as possible?	
	Extent of compliance/noncompliance:	1 2 3 4
3.	Are ALARA design reviews evaluated and approved by radiological control staff and facility management, as applicable?	
	Extent of compliance/noncompliance:	1 2 3 4

Figure 7-1. Example of WHC Internal Program Review. (sheet 8 of 10)

	J. ALARA WORK PLANNING	Status Ranking
1.	Are plans and procedures controlling work in the facility developed using radiation work permits and ALARA reviews to control worker exposures and the spread of contamination?	
	Extent of compliance/noncompliance:	1 2 3 4
2.	Are these reviews identified by, and integrated with, the RWP process?	
	Extent of compliance/noncompliance:	1 2 3 4
3.	Are preliminary estimates of time and radiation dose for the activity, and any special ALARA controls, provided as appropriate?	
	Extent of compliance/noncompliance:	1 2 3 4
4.	Are these documents approved by supervisors in the radiological control organization?	
	Extent of compliance/noncompliance:	1 2 3 4
5.	Is the RWP and ALARA review process described in the ALARA Program implementing procedure for the facility?	
	Extent of compliance/noncompliance:	1 2 3 4
6.	Is a Post ALARA Review performed to document lessons learned and provide a final assessment for the job?	
	Extent of compliance/noncompliance:	1 2 3 4
7.	Do the post-job reviews performed at the facility compare the actual person-hours and person-rem with the pre-job estimates?	
	Extent of compliance/noncompliance:	1 2 3 4

Figure 7-1. Example of WHC Internal Program Review. (sheet 9 of 10)

	J. ALARA WORK PLANNING (CONT.)	Status Ranking
8.	Does the post-job review evaluate the effectiveness of ALARA controls?	
	Extent of compliance/noncompliance:	1 2 3 4
9.	Does the post-job review make recommendations to reduce dose for similar activities?	
	Extent of compliance/noncompliance:	1 2 3 4

	K. RECORDS	
1.	Is ALARA program documentation being used prior to work commencement on nonroutine or complex work activities?	
	Extent of compliance/noncompliance:	1 2 3 4
2.	Does the facility or organizational ALARA Committee review the status of exposure trends, measure ALARA goal accomplishment and analyze the effectiveness of implementing the ALARA Program?	
	Extent of compliance/noncompliance:	1 2 3 4
3.	Does the facility or organization ALARA Committee maintain training records, actions taken to attain and maintain occupational exposure ALARA, and maintain records documenting the results of internal program reviews and work practice assessments?	
	Extent of compliance/noncompliance:	1 2 3 4
4.	Are all documents and legal records used to demonstrate compliance with the requirements for the ALARA Program reviewed and approved by line management?	
	Extent of compliance/noncompliance:	1 2 3 4

Figure 7-1. Example of WHC Internal Program Review. (sheet 10 of 10)

	K. RECORDS (CONT.)	Status Ranking
5.	Does the facility or organizational ALARA Committee maintain a file of associated ALARA documentation and make it available to personnel as requested (e.g., AMWs, goals, investigation reports, meeting minutes, PARs)?	
	Extent of compliance/noncompliance:	1 2 3 4
6.	Does the facility/organization ALARA Committee make use of lessons learned from other facilities by reviewing the SHARE database?	
	Extent of compliance/noncompliance:	1 2 3 4

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Optimization Methodology

Approved by

A. G. King, Manager
Analytical Services

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1.0 PURPOSE

To document that optimization methods are used to ensure that occupational exposure is maintained as low as reasonably achievable (ALARA) in developing and justifying facility design and physical controls.

2.0 SCOPE

This procedure is used to determine which dose reduction and contamination minimization efforts are reasonable and the costs and benefits of reducing occupational doses. This process involves judgements to evaluate the "appropriateness" of ALARA protective measures based on the relative value of social, technical, and economic factors. An optimization analysis should be prepared to evaluate occupational dose reduction features for major modifications of existing facilities and designs of new facilities.

3.0 DEFINITIONS

Cost/Benefit Analysis (CBA) or Optimization Methodology

A documented methodology which describes how the factors affecting a protection decision, e.g., social, technical, economic, practical, and public policy, are assigned values to compare detriment and benefits. (Reference Appendices A,B, and C and Figures 8-2 through 8-9.)

Optimization

The process of making something, such as a design, system, or operational practice as perfect, functional, or effective as possible. The optimal level of radiation protection for a particular work practice depends on many factors including cost, reduction in risk, and the detriment associated with the dose.

4.0 RESPONSIBILITIES

4.1 Design of New Facilities or Major Modification of Old Facilities

Facility and ESQ/RC Managers

1. Ensure that optimization techniques are used, and documented, to assure that occupational exposure is maintained ALARA in developing and justifying facility design and physical controls.

2. Ensure decisions on the costs and benefits of reducing occupational doses and contamination minimization involve judgments on the relative value of social, technical, and economic factors.

3. Control personnel exposure from external sources of radiation in areas of continuous occupational occupancy (2000 hours per year) below an average of 0.5 mrem per hour and as far below this average as is reasonably achievable.

4. Control potential exposure to a radiological worker where occupancy differs from the above ALARA and not to exceed 20 percent of the applicable standards in 10 CFR 835.202.

5. Control airborne radioactive material, by the use of confinement and ventilation, to avoid releases to the workplace atmosphere. Control the inhalation of any such material by workers to levels that are ALARA.

6. Evaluate access paths to work areas and high radiation areas that are near locations such as lunchrooms, offices, conferences rooms. Review the radioactive piping route through the work area.

Facility and ESQ/RC Managers

7. Ensure the design or modification of a facility and the selection of materials include features that facilitate operations, maintenance, decontamination, and decommissioning.

8. Ensure that the level of effort involved in documenting ALARA decisions is commensurate with the costs and potential dose savings to be realized.

ESQ/RC Managers

9. Ensure that the optimization process is documented, retained and distributed to the ALARA Program Office per requirements in Section 11.

10. Make assignments, as required, for performing optimization evaluations.

5.0 RECORDS

Any records generated as a result of this activity will be handled in accordance with applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance & Support	T6-14
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28

7.0 REFERENCES

10 CFR 835, 1993, "Occupational Radiation Protection, Subpart B, Radiation Protection Programs," *Code of Federal Regulations*, as amended.

APPENDIX A

WESTINGHOUSE HANFORD COMPANY OPTIMIZATION METHODOLOGY
(Cost/Benefit Analysis)

The policy of the DOE is to operate its facilities and conduct its research to maintain radiation exposures as far below the prescribed limits as is reasonably achievable. Optimization is the process of making something, such as a design, system, or operational practice as perfect, functional, or effective as possible. ICRP-55 states that "...optimization provides a basic framework of thinking wherein it is proper to carry out some kind of balancing of the resources put into production, and the level of protection obtained against a background of other factors and constraints, so as to obtain the best that can be achieved in the circumstances." ALARA is synonymously defined in DOE/EH-0256T as "An approach to radiological control to manage and control exposures (both individual and collective) to the work force and general public at levels as low as reasonable, taking into account social, technical, economic, practical, and public policy considerations. As used in this Order, ALARA is not a dose limit but a process, which has the objective of attaining doses as far below the applicable controlling limits as is reasonably achievable."

To determine if alternatives will reduce dose and the spread of radioactive contamination to as low as is reasonably achievable, a quantitative method or decision-making techniques should be employed. DOE/EH-0256T requires that design objectives use the optimization principles, such as those discussed in ICRP-37 when justifying changes in facility design to control occupational exposure. ICRP-55 also provides relevant guidance on optimization and the decision-making process. DOE 5400.5 requires that "...contractors develop a program to implement the ALARA process for all activities that cause dose to the general public." Furthermore, DOE 5400.5 states that "...Factors to be considered, at the minimum, shall include:

1. The maximum dose to the public
2. The collective dose to the population
3. Alternative methods of processing, treating, controlling, and operating radioactive effluent systems
4. The dose associated with each alternative
5. The cost for each technological alternative
6. Examination of the changes in costs associated with the various alternatives
7. Examination of the changes in societal impact associated with the various alternatives."

In addition, PNL-6577 states that the following minimum steps are needed for cost/benefit analysis to optimize dose reduction:

"1. Identify all possible options...
2. For each option, determine both the individual and collective dose equivalent that will result...
3. For each viable option, identify all associated costs and determine the net cost for each option by summing the identified costs...
4. Determine the cost equivalent of the doses resulting from each option...
5. Sum the costs identified in Steps (3) and (4) to determine the total net cost for each option...
6. The option with the lowest total net cost is the optimal option...

7. A sensitivity analysis should be performed to determine how the solution depends on the assumptions that are required to perform the optimization analysis..."

During the initial stages of the conceptual design and throughout the design phase, but prior to the final selection of the applicable ALARA design consideration, it may be necessary for the cognizant engineer or his designated alternate to perform a cost/benefit analysis. Those changes to the design for which costs do not have an obvious justification and which significantly increase the total project's cost should have a quantitative cost/benefit performed.

The cost/benefit analysis involves estimating the net costs and net benefits associated with the design change. These costs and savings must be estimated over the life of the new technique. In addition, if adjustment of costs or savings is needed to correct inflation, then Future Value Factors can be used to update estimates from the past to the base year.

The costs from the new technique which may require estimation are:

- Engineering Costs
- Installation Labor Costs
- Capitol Equipment, Fabrication, and Materials Costs
- Training, Procedures, Operating, and Maintenance Costs
- Chemical Costs
- New Tool Costs
- Consumable Costs
- Dose Increase Costs.

The benefits for the new techniques which may require estimation are:

- Maintenance Savings
- Operations Savings
- Surveillance/Inspection Savings
- Replacement Power Savings
- Improved Efficiency and Reliability Savings
- Rad Waste Savings
- Salvage Savings
- Decreased Usage of Chemical and Consumable Material Savings
- Dose Savings.

The dose increase and savings in person-rem can be converted to dollars using a lower limit value of $2,000 or an upper limit value of $10,000 per person-rem (DOE EH-0277-T). This will allow these costs and savings to be added to the other cost and savings to determine if the net dollars is a cost or a benefit.

A summary of the description and results of any cost benefit to be performed should be documented on the cost benefit analysis worksheets (see Figures 8-2 through 8-9). The inclusion of the completed cost benefit analysis worksheet to the work package is optional.

There are four major steps to this cost/benefit methodology:

1. Define the radiological problem
2. Perform the overriding factor analysis
3. Calculate the net benefit
4. Perform the ALARA factor analysis.

The types of data that will be needed to define the problem are a written description of the radiological problem, a description of the alternatives for ALARA protective measures (APM), the time frame for which the protective measure will be used, the savings, the costs, and the estimates for collective and maximum individual dose. See Figure 8-1 for a flow chart of the ALARA protective measure analysis process, and Figure 8-2 for a worksheet that can be used to define radiological problems.

After the problem is defined and the data collected, an overriding factor analysis is performed. This involves asking such questions as:

- Will a violation of a DOE Order, federal regulation, or state law occur?
- Will a violation of a collective bargaining agreement be generated by the activity?
- Will significant quantities of radioactive material be added to the site?
- Will administrative dose control level(s) be exceeded?
- Will a safety related activity not be completed because a specially trained, skilled, or certified worker is unavailable?
- Will an unsafe condition that could lead to worker injury be created?

These questions are answered yes or no for each scenario: an APM should be implemented or an APM should not be implemented (see Figure 8-3). If there are overriding criteria against implementing the APM, then it is not justified. Conversely, if there are overriding criteria for implementing the APM, then it is justified regardless of the costs or benefits.

Next, the net benefit analysis will be performed. First, calculate the marginal or differential economic benefits, including such benefits as maintenance labor savings, operational/production savings, inspection/surveillance savings, process efficiency/reliability savings, as well as other miscellaneous saving (see Figure 8-4). Second, calculate the marginal potential costs, such as those costs associated with design and engineering; materials, equipment, and fabrication; installation/construction; training and procedures; operating and maintenance; as well as other miscellaneous costs, e.g., chemicals, consumables, special tools, and rad waste disposal (see Figure 8-5). Third, calculate net dose savings. This equates to the dose associated with the existing radiological activity minus the dose with the APM implemented and the dose to implement the APM (see Figure 8-6).

Next, evaluate whether or not the net benefits are positive. To obtain the net benefit, subtract the estimated economic costs (Box D in Figure 8-5) from the estimated economic benefits (Box C in Figure 8-4). In addition, add the benefits to be accrued by the dose savings to the net benefit. To do this convert the net dose savings (Box E in Figure 8-6) to its equivalent dollar value. For this exercise, a two-tiered detriment value system will be used which is based on a study on the evaluation of a unit of dose performed by Brookhaven National Laboratory (DOE EH-0277T). This methodology

is based on the estimated dose to the maximum individual without the protective measure. A value of $2,000 per person-rem is suggested as a nominal value for low dose operations where the maximum individual is estimated to receive a dose less than 1 rem/yr. An upper level value for dose detriment of $10,000 per person-rem will be used for those high dose activities where the maximum individual is estimated to receive a dose equal to or greater than 1 rem/yr.

If, after adding the benefit of net dose savings expressed in dollars, for the lower level detriment value of $2,000 to the previously calculated economic net benefit (see Figure 8-7), the net benefit is greater than zero, then the protective measure is justified. If it is not, then an ALARA factor analysis should be performed (see Figure 8-9). If the upper level net benefit evaluation, i.e., $10,000/person-rem, are not less than zero, then an ALARA factor analysis should be performed (see Figure 8-9). If the net benefits are less than zero, then the measure is not justified. At this point a case-specific evaluation could be performed to determine if assignment of a radiation detriment value of greater than $10,000 per person-rem is warranted. This could result in the measure being justified.

Finally, for those situations in which an ALARA factor analysis will be required, answer yes or no to the questions that deal with qualitative factors and enter the value of the corresponding weighing factor into either the yes or no box. If, after tallying these weighing factors, the yes total is greater than that for the no answers, the APM should be accepted based on qualitative factors. If the no answer total outweighs that for the yes answers, or if they are equal, the APM should be rejected or accepted based on other factors.

Appendix B provides an example of how to apply data shown in Figures 8-2 through 8-9 in a cost-benefit analysis. A worksheet format is used in Appendix B to help clarify the example given.

Figure 8-1. ALARA Protective Measure Analysis - Flow Chart.

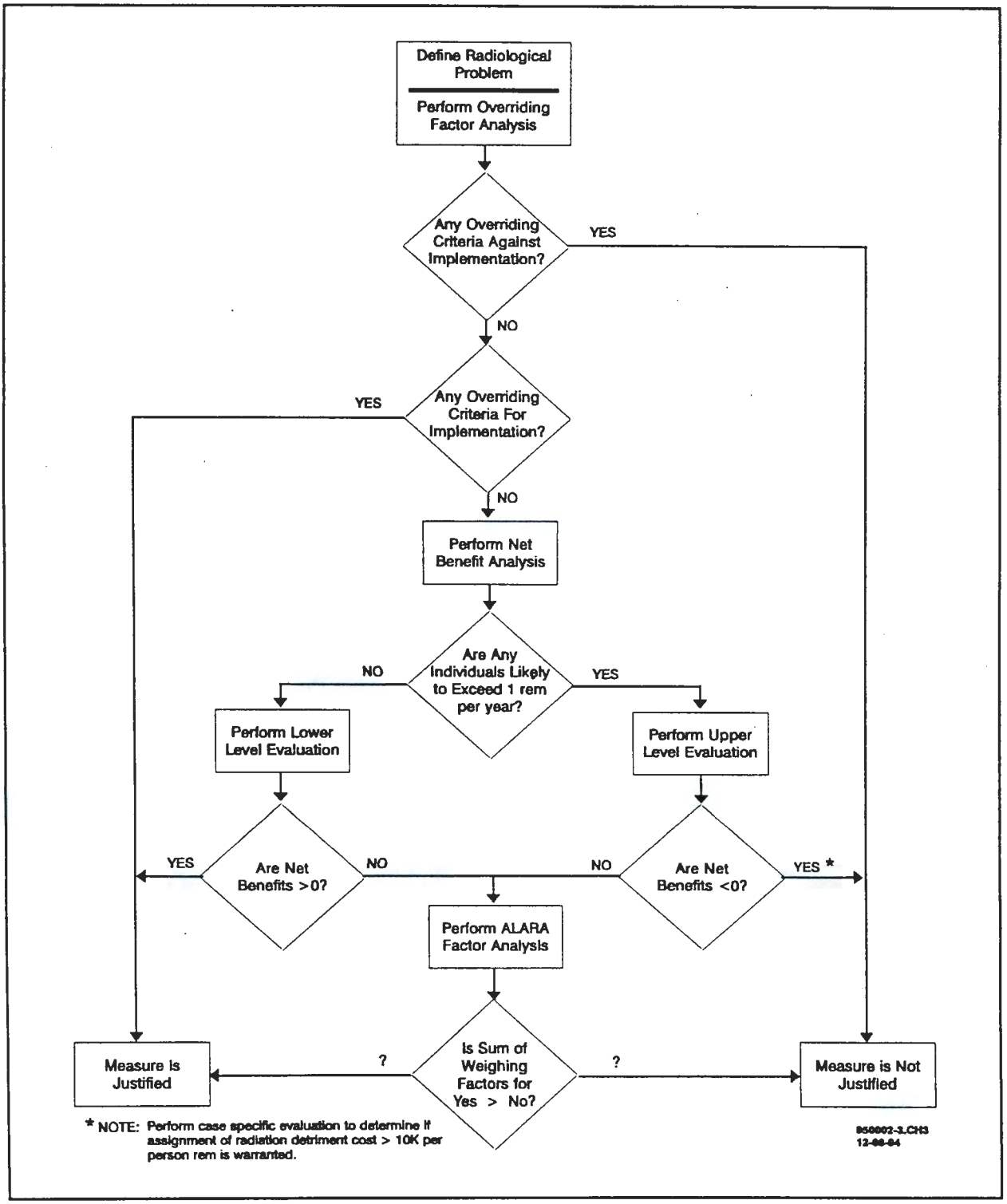


Figure 8-2. Radiological Problem Definition

1. Describe the facility, its present radiological conditions, and the radiological activity of concern.

2. Describe the proposed ALARA protective measure (APM).

3. Determine the relevant time frame (for estimation of cost elements and exposure impacts) for which the protective measure will be used.

4. Identify the cost savings associated with the implementation of the APM (e.g., maintenance labor, operations labor, inspection labor, production, processing, salvage, reduced chemicals, reduced consumables, reduced rad waste).

5. Identify the cost elements for implementation of the APM (e.g., design and engineering, equipment procurement, fabrication, installation or construction labor, operation, maintenance, associated training and procedure, additional chemicals, additional consumables, special tools, additional rad waste).

6. Estimate the collective dose (1) without the protective measure, (2) with the protective measure, and (3) to implement the protective measure. Determine, if possible, the maximum individual dose for the present or existing radiological activity.

Figure 8-3. Overriding Factor Analysis.

Overriding Factors	For each question, indicate either YES or NO	
	If Implemented	If Not Implemented
1. Will a DOE Order, federal regulation, or state law be violated?	_____	_____
2. Will significant quantities of radioactive materials be added to the site?	_____	_____
3. Will a collective bargaining agreement be violated?	_____	_____
4. Will administrative dose control level(s) be exceeded?	_____	_____
5. Will a safety-related activity not be completed because a specially trained, skilled, or certified worker is unavailable?	_____	_____
6. Will an unsafe condition that could lead to worker injury be created?	_____	_____
7. Other factors (please describe). _____ _____ _____ _____ _____ _____	_____	_____

8. Conclusion (explain how YES answers to the above questions are overriding factors).
_____
_____
_____

9. Discussion (basis and references).
_____
_____
_____
_____
_____
_____

Figure 8-4. ALARA Protective Measure Benefit Calculation.

Benefits	Quantity	Unit Cost	Cost	Item(s)
C-1 **Maintenance Labor** Enter the total estimated labor savings for the protective measure. Obtain the estimated total maintenance hours saved. Obtain the appropriate dollar/hour rate for maintenance. Enter the product(s) on line(s) for items C-1.	____ ____ ____	____ ____ ____	____ ____ ____	C-1
C-2 **Operations/Production Labor** Enter the total estimated operation/production labor savings for the protective measure. Obtain the estimated total operation hours saved. Obtain the appropriate dollar/hour rate for operations. Enter the product(s) on line(s) for items C-2.	____ ____ ____	____ ____ ____	____ ____ ____	C-2
C-3 **Inspection/Surveillance Labor** Enter the total estimated inspection/surveillance labor savings for the protective measure. Obtain the estimated total operation hours saved. Obtain the appropriate dollar/hour rate for inspection. Enter the product(s) on line(s) for items C-3.	____ ____ ____	____ ____ ____	____ ____ ____	C-3
C-4 **Efficiency and/or Reliability Savings** Enter the total estimated savings associated with production or processing improvements provided by the protective measure. Enter the dollar amount of these savings on line(s) for items C-4.	____ ____ ____	____ ____ ____	____ ____ ____	C-4
C-5 **Miscellaneous Savings** Enter estimated savings from miscellaneous items (e.g., salvage value of old equipment, reduced chemical and consumable materials, reduced rad waste). Enter the dollar amount of these savings on line(s) for items C-5.	____ ____ ____	____ ____ ____	____ ____ ____	C-5

TOTAL ECONOMIC BENEFITS
Enter the total estimated benefits of the protective measure. Add all savings from lines for items C-1 through C-5, and enter total into Box C.

Grand Total → ☐ Box C

Figure 8-5. ALARA Protective Measure Cost Calculation.

Benefits	Quantity	Unit Cost	Cost	Item(s)
D-1 **Design and Engineering** Enter the total estimated design engineering cost for the protective measure. Obtain the estimated hours to design and engineer the productive measure. Obtain appropriate dollar/hour rate for engineering. Enter the product(s) on line(s) for items D-1.	____ ____ ____	____ ____ ____	____ ____ ____	D-1
D-2 **Capital Equipment, Fabrication, Material** Enter the total estimated capital costs of equipment, fabrication, and materials for the new technique. Include "up front" hidden costs such as R&D, certification, patent rights, etc. Enter product(s) on line(s) for items D-2.	____ ____ ____	____ ____ ____	____ ____ ____	D-2
D-3 **Installation or Construction** Enter the total estimated labor costs to install the protective measure. Obtain the estimated total hours of station and contractor personnel to install. Obtain the appropriate dollar/hour rate for station and contractor labor. Enter the product(s) on line(s) for items D-3.	____ ____ ____	____ ____ ____	____ ____ ____	D-3
D-4 **Implementation: Procedure, Training, Administrative Costs** Enter the estimated costs for training, procedure development, and associated additional O&M protective measure (additional O&M being a negative savings obtained in lines C-1, C-2, and C-3 above from the difference between the existing and the protective technique costs for operations, maintenance, and inspection). Enter the product(s) on line(s) for items D-4.	____ ____ ____	____ ____ ____	____ ____ ____	D-4
D-5 **Operation and Maintenance** Enter the total estimated cost to operate and maintain the protective measure. Obtain the estimated hours to maintain and operate. Obtain the appropriate dollar/hour rate for each work group. Enter the product(s) on line(s) for items D-5.	____ ____ ____	____ ____ ____	____ ____ ____	D-5
D-6 **Miscellaneous Costs** Enter the estimated total costs for miscellaneous items (e.g., chemicals, consumable materials, special tools, additional rad waste). Enter the product(s) on line(s) for item(s) D-6.	____ ____ ____	____ ____ ____	____ ____ ____	D-6

TOTAL ECONOMIC COSTS

Enter the total estimated costs of the protective measure. Add all the costs from lines for items D-1 through D-6 and enter total into Box D.

Grand Total → ☐ Box D

Figure 8-6. Dose Estimate.

Description of Radiological Activity	Work Group or Number of Persons	Exp-Hr	Average Dose Rate	Person Rem	Item(s)
E-1 **Existing or Present Radiological Activity**	Enter the existing man-hours to perform activity, maintenance, operate, inspect, process, or produce. Enter the average working dose rate for each activity. Enter the product(s) on line(s) for item(s) E-1.				
_____	_____	_____	_____	_____	E-1
_____	_____	_____	_____	_____	
_____	_____	_____	_____	_____	
E-2 **Dose with APM Implemented**	Enter the total person-hours with the protection measure for maintenance, operation, inspection, processing, and production. Enter the average working dose rate for each activity. Enter the product(s) on line(s) for item(s) E-2.				
_____	_____	_____	_____	_____	E-2
_____	_____	_____	_____	_____	
_____	_____	_____	_____	_____	
E-3 **Dose to Implement APM**	Enter the total estimated dose to implement or install the protection measure which will result from it (i.e., negative result from the person-rem to operate, maintain, inspect old technique minus person-rem to operate, inspect new technique) on line(s) for item(s) E-3.				
_____	_____	_____	_____	_____	E-3
_____	_____	_____	_____	_____	
_____	_____	_____	_____	_____	

NET DOSE SAVINGS

Enter total estimated dose saved for the protective measure (i.e., positive results from the person-rem to operate, maintain, inspect old technique minus person-rem to operate, maintain, inspect with protective measure plus the dose to implement the APM) in Box E.

E1-E2+E3 = →

Box E

Figure 8-7. Lower-Level Net Benefit Evaluation.

Cost/Benefit	Dollars	Item(s)
F-1 **Estimated Economic Benefits** Enter the results from Box C on line for Item F-1.	____	F-1
F-2 **Estimated Economic Costs** Enter the results from Box D on line for item F-2.	____	F-2
F-3 **Net Economic Benefit (Costs)** Estimated benefit on line for item F-1 minus estimated cost on line for item F-2. Enter (F-1) - (F-2) on line F-3.	____	F-3

Net Dose	Person-Rem	Dollars/ Person Rem	Dollars	Item(s)
F-4 **Net Dose Savings** Enter the result from Box E and multiply by $2,000 person-rem. Enter result on line for item F-4.	____	x $2,000 =	____	F-4

Net Benefit
Net benefit on line F-3 plus the dollar value of the net dose savings on line for item F-4, i.e., (F-3) + (F-4).

Box F

Net Benefit Decision Index	Accept	Reject	Indifferent
Depending on the value of Net Benefit, circle one of the following:	>0	<0	0

If the net benefit is >0, accept the protective measure.

If the net benefit is ≤0, perform an ALARA factor analysis.

Figure 8-8. Upper-Level Net Benefit Evaluation.

Cost/Benefit	Dollars	Item(s)
F-1 **Estimated Economic Benefits** Enter the results from Box C on line for Item F-1.	____	F-1
F-2 **Estimated Economic Costs** Enter the results from Box D on line for item F-2.	____	F-2
F-3 **Net Economic Benefit (Costs)** Estimated benefit on line for item F-1 minus estimated cost on line for item F-2. Enter (F-1) - (F-2) on line for item F-3.	____	F-3

Net Dose	Person-Rem	Dollars/ Person Rem	Dollars	Item(s)
F-4 **Net Dose Savings** Enter the result from Box E and multiply by $10,000 person-rem. Enter result on line for item F-4.	____	x $10,000 =	____	F-4

Net Benefit
Net benefit on line F-3 plus the dollar value of the net dose savings on line F-4, i.e., (F-3) + (F-4).

Box F

Net Benefit Decision Index	Accept	Reject	Indifferent
Depending on the value of Net Benefit, circle one of the following:	>0	<0	0

If the net benefit is >0, proceed to Figure 8-9 and perform the ALARA factor analysis.

If net benefit is ≤0, either reject the protective measure or reevaluate the upper level net benefit using a case-specific value for the radiation detriment instead of $10,000 per person-rem.

Figure 8-9. ALARA Factor Analysis and Checksheet.

ALARA Factor Analysis

When the cost of an APM falls between the upper and lower limits of X, it must be evaluated against established ALARA factors. The following ALARA factors have been established for Westinghouse Hanford Company.

Evaluation of an ALARA factor analysis is determined by balancing the weighted "yes" answers against the weighted "no" answers. If there is a higher total of "yes" than "no," the APM is considered cost effective. If there is a higher total of "no" than "yes" the APM is not considered cost effective. The effort expended in quantifying these factors should be commensurate with the scope of the project.

1. Will the maximum individual doses for occupational workers exceed 10 mrem (0.1 mSv) for the duration of the relevant time frame?

   Weighting Factor: 3

   Discussion: This is an extrapolation of the negligible individual dose level recommended by the National Council on Radiation Protection and Measurements, 1 mrem (0.01 mSv). The 1-mrem (0.01-mSv) dose cited by the report was in reference to nonoccupational workers; since occupational limits are traditionally a factor of 50 higher, a value of 10 mrem (0.1 mSv) was selected. This does not indicate that 10-mrem (0.1 mSv) effective dose equivalents are insignificant, but for defining individual factors to be used to assess the overall cost effectiveness of a measure, it is a valid consideration.

2. Does the APM maintain or decrease the current level of risk for occupational incidents or accidents?

   Weighting Factor: 2

   Discussion: APMs that increase the risk of occupational incidents or accidents possess an inherently negative factor.

3. Does the APM decrease the risk of environmental incidents or accidents?

   Weighting Factor: 2

   Discussion: APMs that decrease the risk of environmental incidents or accidents possess inherently positive factors.

4. Does the APM result in collective dose savings in the post operational phase of operations?

   Weighting Factor: 2

   Discussion: APMs can affect the effective dose equivalents to be received in the post operational phase of a facilities operation. If the proposed APM can be shown to reduce exposure during this phase, even if not quantifiable, this can be considered a positive factor in the overall process.

5. Does the APM result in cost savings during the post operational phase of operations?

   Weighting Factor: 1

   Discussion: APMs can affect a facility in a variety of ways. If it can be shown that the APM will provide a future cost savings, even if not specifically quantifiable, such cost savings would be considered a positive aspect of the APM.

6. Does the APM increase the flexibility of personnel or other resources?

   Weighting Factor: 2

   Discussion: Certain APMs may not contribute to significant exposure reduction but would have a positive effect on facility operations. The APMs that affect entry requirements or other administrative controls should be considered in this area.

7. Does the APM result in an improved relationship with internal or external organizations?

   Weighting Factor: 1

   Discussion: If an APM can be said to improve the relationship between union and management, company and customer, or customer and outside oversight group, this is a positive consideration in evaluating the APM.

8. Does the APM decrease or not increase employee exposure to adverse working conditions or extreme discomfort?

   Weighting Factor: 2

   Discussion: Specific APMs often rely on additional protective clothing, masks, or other similar factors. When these factors result in adverse working conditions or extreme worker discomfort, this should be considered a negative aspect of the APM.

9. Does the APM reduce the release of radionuclides to the environment?

   Weighting Factor: 3

   Discussion: Reduction of radionuclides to the environment, even if existing levels are within current limits, is a positive factor in considering an APM.

10. Does the APM improve or maintain current level of operability for an activity or facility?

    Weighting Factor: 2

    Discussion: If the implementation of an APM will restrict access to portions of a facility, curtail operations, or in some significant way hamper routine operations, this would be considered a negative aspect of the APM.

11. Is the adverse impact of the APM on the activity schedule minimal?

    Weighting Factor: 2

    Discussion: Implementation of an APM will invariably have some adverse impact on schedule. Only when the impact is extreme, i.e., a significant milestone is missed, should this be considered a negative aspect.

12. Does the APM contribute to waste minimization?

    Weighting Factor: 1

    Discussion: Waste minimization is a key concept of ALARA; therefore, any contribution to the waste minimization program is a positive factor to be considered.

ALARA Factor Analysis Checksheet

Question	Weighting Factor	Yes	No
1. Will the maximum individual doses for occupational workers exceed 10 mrem (0.1 mSv) for the duration of the relevant time frame?	3		
2. Does the APM maintain or decrease the current level of risk for occupational incidents or accidents?	2		
3. Does the APM decrease the risk of environmental incidents or accidents?	2		
4. Does the APM result in collective dose savings in the post operational phase of operations?	2		
5. Does the APM result in cost savings during the post operational phase of operations?	1		
6. Does the APM increase the flexibility of personnel or other resources?	2		
7. Does the APM result in an improved relationship with internal or external organizations?	1		
8. Does the APM decrease or not increase employee exposure to adverse working conditions or extreme discomfort?	2		
9. Does the APM reduce the release of radionuclides to the environment?	3		
10. Does the APM improve or maintain current level of operability for an activity or facility?	2		
11. Is the adverse impact of the APM on the activity schedule minimal?	2		
12. Does the APM contribute to waste minimization?	1		
Total			

APPENDIX B

EXAMPLE OF INSTALLING A CLOSED-CIRCUIT TELEVISION TO MONITOR THE SPENT FUEL POOL HEAT EXCHANGER ROOM

Part A: Radiological Problem Definition

1. Describe the facility, its present radiological conditions, and the radiological activity of concern.

   The facility is either a production, research, or test reactor. The radiological activity of concern is the routine inspection by operations of the spent fuel pool heat exchanger cubicle. The purpose of these routine inspections is to monitor for leaks and equipment malfunctions (visually). The radiation levels in the room are on the average 100 mrem/hr with hot spots of 1-10 rem/hr.

2. Describe the proposed ALARA protective measure (APM).

   These routine visual inspections could be performed remotely using a commercially available camera with a pan/zoom lens and a trainable (vertical and azimuth) mount and associated monitor/control panel.

3. Determine the relevant time frame for estimation of cost elements and exposure impacts.

   The relevant time frame is 10 years based on the expected lifetime of the camera in the environment.

4. Identify the cost savings associated with the implementation of the APM, e.g., maintenance labor, operations labor, inspection labor, production, processing, salvage, reduced chemicals, reduced consumables, reduced rad waste.

   Inspection labor savings of 5 min/day or 30 hours/year. An operations labor rate, including overhead, is $35.00/hour.

5. Identify the cost elements for implementation of the APM, e.g., design and engineering, equipment procurement, fabrication, installation or construction labor, operation, maintenance, associated training and procedure, additional chemicals, additional consumables, special tools, additional rad waste.

   The cost for the camera, stand, and control panel is approximately $5,000. It will require about 100 person-hours to install (50 person-hours in radiation area and 50 person-hours in a nonradiation area). Contractor labor to install and test is billed at a rate of $20.00/hour.

6. Estimate the collective dose without the protective measure, with the protective measure, and to implement the protective measure. Determine, if possible, the maximum individual dose for the present or existing radiological activity.

   The exposure impacts assuming all exposures associated with inspections are eliminated are:

   Collective dose without protective measure: 3.000 rem
   Collective dose with protective measure: 0 rem
   Collective dose to implement protective measure: 5.000 rem
   Maximum annual individual dose: 1.5 rem/year.

Part B. Overriding Factor Analysis

Overriding Factors	For each question, indicate either YES or NO	
	If Implemented	If Not Implemented
1. Will a violation of a DOE Order, federal regulation, or state law occur?	No	No
2. Will significant quantities of radioactive materials be added to the site?	No	No
3. Will violation of a collective bargaining agreement occur?	No	No
4. Will worker administrative dose control level(s) be exceeded?	No	No
5. Will a safety-related activity not be completed because of the unavailability of a specially trained, skilled, or certified worker?	No	No
6. Other factors (please describe).	–	–

7. Conclusion (explain how YES answers to the above questions are overriding factors).
No overriding factors apply for the use of a remote video monitor in the spent fuel heat exchanger cubicle.

9. Discussion (basis and references).

Part C. APM Benefit Calculation

Benefits	Quantity	Unit Cost	Cost	Item(s)
C-1 **Maintenance Labor** Enter the total estimated labor savings for the protective measure. Obtain the estimated total maintenance hours saved. Obtain the appropriate dollar/hour rate for maintenance. Enter the product(s) on line(s) for items C-1.	____ ____ ____	____ ____ ____	None ____ ____	C-1
C-2 **Operations/Production Labor** Enter the total estimated operation/production labor savings for the protective measure. Obtain the estimated total operation hours saved. Obtain the appropriate dollar/hour rate for operations. Enter the product(s) on line(s) for items C-2.	____ ____ ____	____ ____ ____	None ____ ____	C-2
C-3 **Inspection/Surveillance Labor** Enter the total estimated inspection/surveillance labor savings for the protective measure. Obtain the estimated total operation hours saved. Obtain the appropriate dollar/hour rate for inspection. Enter the product(s) on line(s) for items C-3.	30 hrs. ____ ____	$35.00/hr ____ ____	$1050/yr x 10 yr $10,500	C-3
C-4 **Efficiency and/or Reliability Savings** Enter the total estimated savings associated with production or processing improvements provided by the protective measure. Enter the dollar amount of these savings on line(s) for items C-4.	____ ____ ____	____ ____ ____	None ____ ____	C-4
C-5 **Miscellaneous Savings** Enter the estimated savings from miscellaneous items (e.g., salvage value of old equipment, reduced chemical and consumable materials, reduced rad waste). Enter the dollar amount of these savings on line(s) for items C-5.	____ ____ ____	____ ____ ____	None ____ ____	C-5

TOTAL ECONOMIC BENEFITS
Enter the total estimated benefits of the protective measure. Add all savings from lines for items C-1 through C-5, and enter total into Box C.

Grand Total $ → 10,500

Box C

Part D. APM Cost Calculation.

Benefits	Quantity	Unit Cost	Cost	Item(s)
D-1 **Design and Engineering** Enter the total estimated design engineering cost for the protective measure. Obtain the estimated hours to design and engineer the productive measure. Obtain appropriate dollar/hour rate for engineering. Enter the product(s) on line(s) for items D-1.	____ ____ ____	____ ____ ____	None ____ ____	D-1
D-2 **Capital Equipment, Fabrication, Material** Enter the total estimated capital costs of equipment, fabrication, and materials for the new technique. Include "up front" hidden costs such as R&D, certification, patent rights, etc. Enter product(s) on line(s) for items D-2.	____ ____ ____	____ ____ ____	$5,000 ____ ____	D-2
D-3 **Installation or Construction** Enter the total estimated labor costs to install the protective measure. Obtain the estimated total hours of station and contractor personnel to install. Obtain the appropriate dollar/hour rate for station and contractor labor. Enter the product(s) on line(s) for items D-3.	100 hrs ____ ____	$20.00/hr ____ ____	$2,000 ____ ____	D-3
D-4 **Implementation: Procedure, Training, Administrative Costs** Enter the estimated costs for training, procedure development, and associated additional O&M protective measure (additional O&M being a negative savings obtained in lines C-1, C-2, and C-3 above from the difference between the existing and the protective technique costs for operations, maintenance, and inspection). Enter the product(s) on line(s) for items D-4.	____ ____ ____	____ ____ ____	None ____ ____	D-4
D-5 **Operation and Maintenance** Enter the total estimated cost to operate and maintain the protective measure. Obtain the estimated hours to maintain and operate. Obtain the appropriate dollar/hour rate for each work group. Enter the product(s) on line(s) for items D-5.	____ ____ ____	____ ____ ____	Negligible ____ ____	D-5
D-6 **Miscellaneous Costs** Enter the estimated total costs for miscellaneous items (e.g., chemicals, consumable materials, special tools, additional rad waste). Enter the product(s) on line(s) for item(s) D-6.	____ ____ ____	____ ____ ____	None ____ ____	D-6

TOTAL ECONOMIC BENEFITS
Enter the total estimated benefits of the protective measure. Add all the costs from lines for items D-1 through D-6 and enter total into Box D.

Grand Total → $7,000

Box D

Part E. Dose Estimate.

Description of Radiological Activity	Work Group or Number of Persons	Exp-Hr	Average Dose Rate	Person Rem	Item(s)
E-1 **Existing or Present Radiological Activity**	Enter the existing person-hours to perform activity, maintenance, operate, inspect, process, or produce. Enter the average working dose rate for each activity. Enter the product(s) on line(s) for item(s) E-1.				
	____	30 hr/yr	0.1 Rem/hr	= 30	
	____	x 10 yr	____	____	E-1
	____	____	____	____	
E-2 **Dose with APM Implemented**	Enter the total person-hours with the protection measure for maintenance, operation, inspection, processing, and production. Enter the average working dose rate for each activity. Enter the product(s) on line(s) for item(s) E-2.				
	____	None	None	0	
	____	____	____	____	E-2
	____	____	____	____	
E-3 **Dose to Implement APM**	Enter the total estimated dose to implement or install the protection measure which will result from it (i.e., negative result from the person-rem to operate, maintain, inspect old technique minus person-rem to operate, inspect new technique) on line(s) for item(s) E-3.				
	____	50	0.1 Rem/hr	5.00	
	____	____	____	____	E-3
	____	____	____	____	

NET DOSE SAVINGS

Enter total estimated dose saved for the protective measure (i.e., positive results from the person-rem to operate, maintain, inspect old technique minus person-rem to operate, maintain, inspect with protective measure plus the dose to implement the APM) in Box E.

E1-E2+E3 = →

25

Box E

Part G. Upper-Level Net Benefit Evaluation.

Cost/Benefit	Dollars	Item(s)
F-1 **Estimated Economic Benefits** Enter the results from Box C on line for Item F-1.	10,500	F-1
F-2 **Estimated Economic Costs** Enter the results from Box D on line for item F-2.	7000	F-2
F-3 **Net Economic Benefit (Costs)** Estimated benefit on line for item F-1 minus estimated cost on line for item F-2. Enter (F-1) - (F-2) on line for item F-3.	3500	F-3

Net Dose	Person-Rem	Dollars/ Person Rem	Dollars	Item(s)
F-4 **Net Dose Savings** Enter the result from Box E and multiply by $10,000 person-rem. Enter result on line for item F-4.	25	x $10,000 =	$250,000	F-4

Net Benefit
Net benefit on line F-3 plus the dollar value of the net dose savings on line F-4, i.e., (F-3) + (F-4).

253,500

Box F

Net Benefit Decision Index	Accept	Reject	Indifferent
Depending on the value of Net Benefit, circle one of the following:	>0	<0	0

If the net benefit is >0, proceed to Figure 8-9 and perform the ALARA factor analysis.

If net benefit is ≤0, either reject the protective measure or reevaluate the upper level net benefit using a case-specific value for the radiation detriment instead of $10,000 per person-rem.

APPENDIX C

STEPS LEADING TO AS LOW AS REASONABLY ACHIEVABLE LEVELS

Step 1: Define the Objective and Scope of the Issue to be Analyzed
State the objective of the project or proposal in terms which do not prejudge the means by which the objective is to be achieved. Specify the radiological protection factors to be included and those nonradiological protection factors to be brought into consideration.

Step 2: Identify Protection Options
Generate options for achieving the objective: the aim is to find options which are both practicable and environmentally acceptable. This step provides a strong incentive to consider not only obvious solutions, but also innovative alternatives. It also includes the elimination of impractical options.

Step 3: Estimate the Performance of the Options for Each Factor
Analyze these options to identify the advantages and disadvantages of each option. Use quantitative and qualitative methods when each are appropriate. Incorporate judgmental criteria explicitly.

Step 4: Analytical Solution
Present the results of the quantitative analysis of factors. Present the results of the evaluation concisely and objectively and in a format that can highlight the advantages and disadvantages of each option. Do not combine the results of different measurements and forecasts if this would obscure information which is important to the decision.

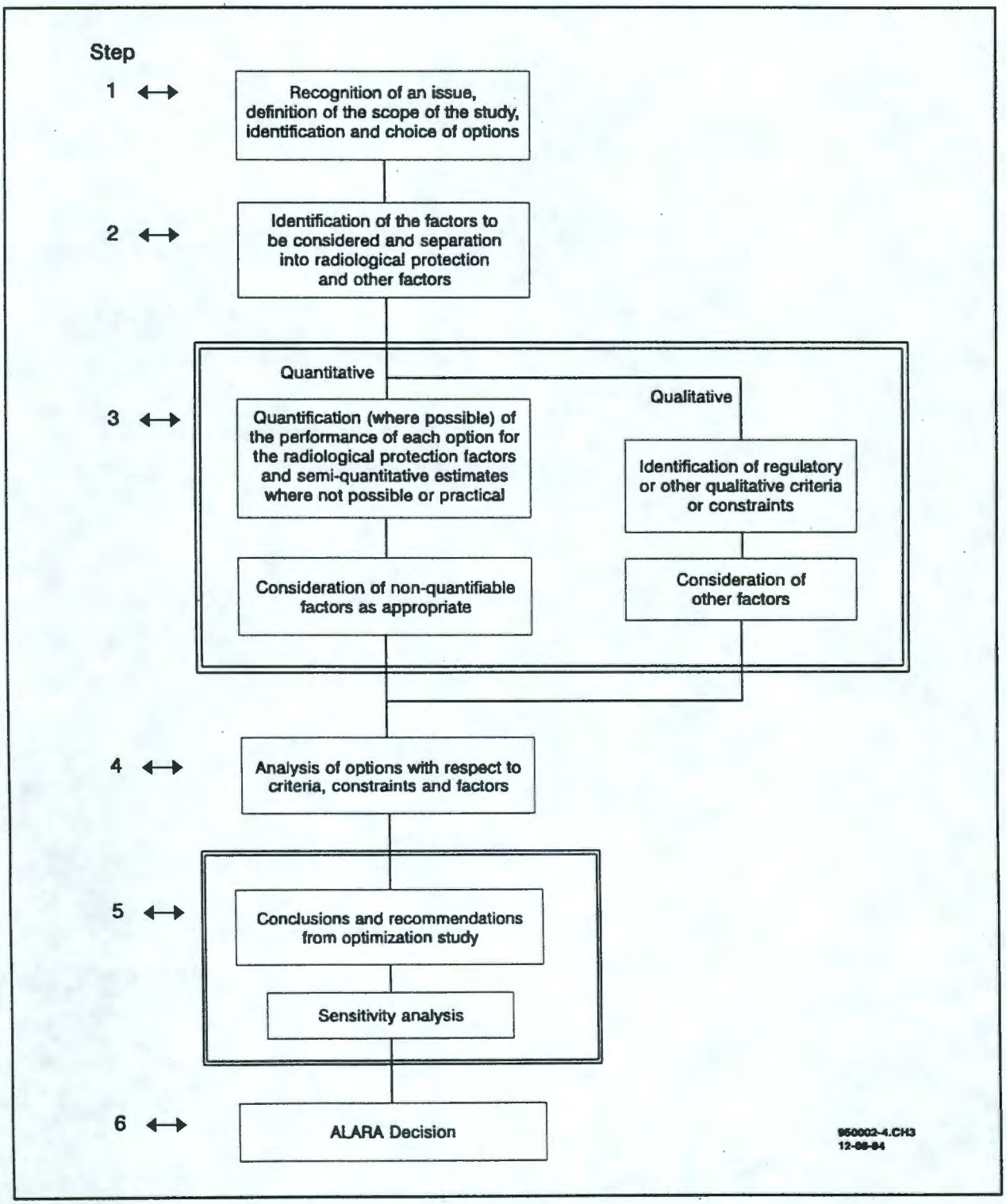
Step 5: Result of Optimization
Select the preferred option from the feasible options. The choice will depend on the weight given to the environmental impacts and associated risks and to the costs involved. Decision makers should be able to demonstrate that the preferred option does not involve unacceptable consequences to the environment. Include consideration of all relevant factors whether treated quantitatively or qualitatively, together with judgment on relative weighing and the results of sensitively analyses to select the recommended radiological optimum.

Step 6: Decision
Take account of the results of optimization and any nonradiological factors and make the decision. Scrutinize closely the proposed detailed design or operating procedures to ensure that no pollution or hazards have ben overlooked. It is good practice to have the scrutiny done by individuals who are independent of the original team.

Step 7: Implement and Monitor
Monitor the achieved performance against the desired targets, especially those for environmental quality. Do this to establish whether the assumptions in the design are correct and to provide feedback for future development of proposals and designs.

Throughout Steps 1 to 7: Maintain an Audit Trail
Record the basis for any choices or decisions through all of these stages; i.e., the assumptions used, the details of evaluation procedures, the reliability and origins of the data, the affiliations of those involved in the analytical work and a record of those making the decision. Record, if possible, the reasons for any departure from the recommended optimum.

Figure C-1. Structured Approach to ALARA Decision Making.



ALARA Design Reviews

Approved by
A. G. King, Manager
Analytical Services

1.0 PURPOSE

To provide a system to ensure that the appropriate radiological design criteria and practices are incorporated into modifications of existing facilities and designs of new facilities early in the engineering and design process. The purpose of the review is to verify that sound radiological considerations such as dose reduction and contamination minimization considerations are integrated into the design, construction procedures, proposed operating procedures, and decommissioning plans at the 222-S laboratory. The Waste Sampling and Characterization Facility (WSCF) and Special Analytical Studies (SAS) handle low-level (<1 mrem/hr) samples; therefore, their operations will not require ALARA design reviews.

2.0 SCOPE

The ALARA design review consists of seven phases: (1) conduct an ALARA Design Review Screening; (2) conduct a dose assessment; (3) review radiological design conditions against established trigger levels; (4) identify the applicable radiological design criteria; (5) select alternatives by using approved optimization methods; (6) in the design package, incorporate and document features to reduce the dose and the spread of radioactive materials; and (7) review of previous similar jobs, designs, and processes that have similar hazards.

3.0 DEFINITION

ALARA Checklist

The mechanism that is designed to assist engineering functions and representatives from Radiological Control (RC) in performing project design and reviews involving new or modified facilities (Macro WEF042, Figure 11.9-2).

ALARA Design Review Screening

The mechanism that is designed to assist engineering functions in determining whether or not an ALARA Checklist will be required (Example Figure 11.9-1).

4.0 RESPONSIBILITIES

4.1 ALARA Design Review Screening

Work Control	1.	Insert a blank ALARA Design Review Screening (DRS) form in each "M" (modification) or "K" (ICF-KH support package) designator JCS work package.
Cog. Engineer	2.	Contact the ALARA Point-of-Contact (POC) for an ALARA DRS

identification number.

3. Complete the ALARA DRS prior to resolution (J-4) of J-1 work packages and prior to release of J-2 packages. If there is a **YES/MAYBE** response to questions 1, 2, or 3 then an ALARA Checksheet, as specified in 4.2, must be completed.

4. Forward original ALARA DRS to the ALARA POC and insert a copy into the work package.

ALARA POC 5. Review ALARA DRS for completeness and log into ALARA DRS binder.

4.2 Dose Assessment

Cog. Engineer and RC Rep. 1. Perform a detailed dose assessment that involves identifying and estimating the dose for the work tasks that involve radiation exposure for operation, maintenance, inspection, and installation of the equipment.

Cog Engineer 2. Record dose assessment on the ALARA Checklist (Figure 11.9-1).

3. If the Total Dose (ALARA Checklist line 6) is less than 1 Person/Rem then no further evaluation is required. If the Total Dose is greater than 1 Person/Rem complete all remaining questions. Exceptions to this will be made for design changes where (1) a like or very similar component that meets the original equipment specifications is replaced or (2) if the design change does not present the practical opportunity to incorporate dose reduction improvements or ALARA considerations, the ALARA design review need not be performed.

4. If the radiation and contamination reduction techniques significantly increase costs perform a cost benefit analysis (CBA) per Section 11.8. If the reduction techniques do not significantly increase cost incorporate and document design considerations into project plan.

4.3 Incorporation and Documentation

Project / Facility Management 1. Approve the results of the ALARA Design Review, including the dose assessment, considerations and criteria review, CBA records (as applicable), and recommendations for reduction.

Cog. Engineer 2. Ensure that the design package includes all of the records and reviews.

3. Incorporate the recommendations that were adopted as a result of the ALARA Design Review into the design package via the formal change process.

ALARA POC 4. Send a copy of the ALARA Checklist (Figure 11.9-2) and CBA, as applicable, to the ALARA Program Office.

5.0 RECORDS

Any records generated as a result of this activity will be handled in accordance with applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance & Support (Champion)	T6-14
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28

7.0 REFERENCES

10 CFR 835, 1993, "Occupational Radiation Protection, Subpart B, Radiation Protection Programs," *Code of Federal Regulations*, as amended.

Figure 9-1. (sheet 1 of 2)

ALARA DESIGN REVIEW SCREENING

1. Identification Number:	2. JCS Number:	Page ^B of
3. Work Package Title:		

INSTRUCTIONS: Respond to each question and provide justification for each N/A or No response. A restatement of the question does not constitute a satisfactory justification or basis. An adequate justification provides sufficient explanation such that an independent reviewer could reach the same conclusion based on the information provided.

QUESTIONS

1. Will the proposed change create a dose rate of at least .5 mrem/hr or increase the dose rate from an existing source?
   [] N/A [] No [] Yes/Maybe

   BASIS:

2. Does the proposed change represent a dose accumulation of at least 100 mrem/yr through new/increased maintenance operations or inspections?
   [] N/A [] No [] Yes/Maybe

   BASIS:

3. Will the proposed change result in cumulative dose of greater than 1,000 mrem to install?
   [] N/A [] No [] Yes/Maybe

   BASIS:

_____
Cognizant Engineer Signature

Date: _____

If there is a **YES/MAYBE** response to questions 1, 2, or 3 then identify ALARA design considerations and document them on the ALARA Checklist (Macro WEF042).

Figure 9-1. (sheet 2 of 2)

ALARA DESIGN REVIEW SCREENING

1. Identification Number:	2. JCS Number:	Page ^B of
3. Work Package Title:		

The following guidance should be considered when completing this screening. This guidance should not be considered all-inclusive; additional factors may need to be considered depending on the nature of the proposed change.

Does the proposed change:

1) Results in the routine use of supplemental dosimetry.
2) Require the use of a job specific RWP.
3) Require the use of respiratory protection for maintenance and/or operating activities.
4) Represent tasks that have not been previously performed.
5) Result in the creation of a radiation or high radiation area.

Figure 9-2. (sheet 1 of 3)

ALARA DESIGN REVIEW CHECKLIST

Project/Cognizant/Design Engineer	Work Identification Number
Signature	Date

Criteria	Remarks
I. DOSE ASSESSMENT	
1. Identify and list the work tasks that will involve radiation exposure for operation, maintenance, inspection, or installation of the equipment.	
2. For each task, describe the work location. Be specific; specify components and approximate distances. This information will be used to obtain an estimate of the effective dose rate.	
3. Estimate the annual amount of time for each task in person-hours. Adjustment factors may be needed to correct for differences in work efficiency caused by protective clothing, respirators, experience level, etc.	
4. Estimate the effective dose rate for each task in rem/hr. Adjustment factors may be needed to correct for differences in dose rates caused by shielding, decontamination, flushing, decay, distance, etc.	
5. For tasks which have historical dose data, record the annual collective dose in person-rem. Adjustment factors may be needed to correct or make adjustments for historical dose data from similar work but different tasks or conditions.	
6. Calculate the estimated annual collective dose in person-rem by multiplying Item 3 by Item 4 for each task. Compare this estimate with the historical dose data in Item 5. Select the collective dose estimate that has the highest confidence. Total the estimated dose for each task in the operation, maintenance, inspection, and installation categories and enter the total dose in the appropriate space.	TOTAL DOSE: _____ PERSON/REM

II. RADIOLOGICAL DESIGN CONDITIONS	Yes/No	Remarks
1. Does this design change involve work on a radioactive, or potentially radioactive, system?		
2. Will this design change create a new radiation area or increase the dose rate from an existing source?		
3. Will this design change create or increase routine maintenance, operations, or inspection requirements in the radiological control area?		
4. Will this design change cause workers to receive a total of 1,000 mrem or greater to install?		

III. RADIOLOGICAL DESIGN CRITERIA	Yes/No	Remarks
A. GENERAL 1. Does the design change protect the public and facility personnel from hazards associated with the use of radioactive and other hazardous materials as a result of normal operations, anticipated operational occurrences, and Design Basis Accidents (DBA) conditions, including the effects of natural phenomena pertinent to the site, and maintain these effects ALARA?		

Figure 9-2. (sheet 2 of 3)

ALARA DESIGN REVIEW CHECKLIST (Continued)

III. RADIOLOGICAL DESIGN CRITERIA	Yes/No	Remarks
2. Has compliance with DOE policies regarding nuclear safety, criticality safety, radiation safety, explosives safety, industrial safety, fire protection, environmental protection, and Safeguards and Security (S&S) protection for special nuclear material been reviewed.		
3. Does the design change protect government property and essential operations from the effects of potential accidents?		
4. Has the adequacy of planned radiation monitoring and nuclear criticality safety instrumentation, including considering whether the proposed instrumentation is appropriate for the radiation types and intensities and whether it has suitable redundancy and capability for operation, both under normal operating conditions and in emergency situations been reviewed?		
B. MATERIAL OF CONSTRUCTION 1. Are the material specifications established to decrease the formation of activated corrosion products by specifying materials low in cobalt and nickel content?		
2. Are surfaces smooth and/or painted for easy decontamination?		
3. Are rough surface finishes such as crevices, hole, notches, recesses, socket-head cap screws, and knurled finishes avoided?		
4. Does the facility design and selection of materials include features that facilitate operation, maintenance, decontamination, and decommissioning?		
C. SHIELDING 1. Has design features and administrative controls been used for facilities and equipment to keep radiation exposures in controlled areas ALARA?		
2. Is shielding placed between serviceable components and any substantial radiation source in the area?		
3. Has the combination of design features and administrative control procedures provided that the total effective dose equivalent does not exceed 5.0 rem per year?		
4. If permanent shielding is not feasible, are provisions incorporated for rapid installation of temporary shielding (i.e., shield racks or supports)?		
5. Are external sources of radiation in areas of continuous occupational occupancy (2,000 hrs/yr) been maintained below an average of 0.5 mrem per hour?		
6. Are shields employed to prevent streaming of radiation through doors, pipes, and duct penetrations (e.g., labyrinths or shadow shields)?		
7. Is an adequate safety margin applied to seismic load analysis to accommodate the additional load from temporary shielding?		
8. Has shielding calculations and design been verified to meet ALARA requirements?		
D. ACCESS CONTROL 1. Are traffic pathways and areas that will be frequently used located in low radiation zones?		
2. Is the design able to maintain personnel entry control for each radiological area, commensurate with existing or potential hazards within the area?		

Figure 9-2. (sheet 3 of 3)

ALARA DESIGN REVIEW CHECKLIST (Continued)

III. RADIOLOGICAL DESIGN CRITERIA	Yes/No	Remarks
3. Are areas of the facility which exhibit high occupancy, or are presently uncontrolled, adequately protected from new or increased radiation sources?		
4. Is maximum distance provided between serviceable components and any substantial radiation sources in the area?		
5. Does the entrance to each access point to high and very high radiation areas have the required control features (i.e., locks,physical barriers, etc.)?		
E. CONTAMINATION CONTROL 1. Can containment be established to reduce the spread of contamination, i.e., cribs, catch pans, drip pans, or cofferdams?		
2. Are HEPA filters and/or charcoal used on the exhaust in areas which have the potential for airborne radioactivity?		
3. Are the pressure gradient and airflow such that for flows from areas of low potential for airborne radioactivity to areas of higher potential for airborne radioactivity?		
4. Does the design incorporate features that will reduce the likelihood of cross-contamination of clean systems and unmonitored release pathways?		
F. SERVICE READINESS 1. Is the equipment ready for service as received?		
2. Does the equipment require modification prior to installation? If so, is the modification reflected in applicable documents, and can the modification be performed in a non-radiologically controlled area?		
G. DOCUMENTATION 1. Are all changes, revisions, modifications, and configurations clearly reflected in applicable documents?		

IV. OPTIMIZATION/COST-BENEFIT ANALYSIS	Yes/No	Remarks
1. Is an optimization analysis necessary to show that the expense (in terms of money, person-hours, dose to install and maintain, etc.) of a project or feature of a project is justified in terms of the actual benefit received?		
2. Summary of description and results of any cost benefit that was performed. Include estimates of the net cost and net dose over the expected life of the design change or modification:		

V. INCORPORATION AND DOCUMENTATION	Remarks
1. The results of the ALARA design review and the recommendations for reduction shall be approved by line management.	
2. The recommendations adapted as a result of the ALARA design review should be incorporated into the design or modification package.	
3. A copy shall be sent to the WHC ALARA Program Office.	

Approved By _____ Date _____

ALARA Work Documentation

Approved by
A. G. King, Manager
Analytical Services
12/22/95

1.0 PURPOSE

This section identifies a system to perform a formal, documented, and comprehensive radiological ALARA review for maintenance, operational, or experimental activities that have the potential to exceed the approved radiological trigger levels as delineated in the *Hanford Site Radiological Control Manual* (HSRCM-1).

2.0 SCOPE

The radiological ALARA review process encompasses three discrete phases: (1) pre-job planning and dose assessment; (2) implementation of ALARA controls and dose tracking; and (3) post-job review. The radiological ALARA review process is identified, as applicable, by the Radiological Work Permit (RWP) and integrated into the Job Control System (JCS) process.

3.0 DEFINITIONS

ALARA Management Worksheet (AMW)
The mechanism that provides a formal radiological ALARA review for nonroutine or complex tasks that meet or exceed the established trigger levels (Example Figure 10-1). The AMW documents ALARA practices, pre-job ALARA considerations for planning, and the estimated collective dose for performing the task. The AMW will also document the post-job review upon completion of the task.

Alternate Formal Mechanism
A written procedure or experiment authorization that may be used instead of an RWP as the administrative control over radiological work activities. The alternate formal mechanism shall meet all the requirements of Articles 321 and 323, HSRCM-1 and be incorporated in the ALARA review methodology for each facility per Section 6.

Post ALARA Review (PAR)
The mechanism that provides the formal post-job review (Macro WEF192, Example Figure 10-2). The PAR compares actual person-rem from the task against the estimates in the AMW, as applicable, evaluates the effectiveness of the ALARA controls, documents the lessons learned, and provides input for future, similar activities.

Pre-job ALARA Review Record
The checklist used to document tasks or activities requiring a pre-job briefing (Example Figure 10-3).

Radiological Work Permit (RWP)
An administrative mechanism used to establish radiological controls for intended work activities. The RWP informs workers of area radiological conditions and entry requirements and provides a mechanism to relate worker exposure to specific work activities. The RWP triggers a formal radiological ALARA review AMW based on estimated exposure and contamination projections.

Search Hanford Accessible Reports Electronically (SHARE)
The Hanford Site-wide database for redistributing completed ALARA documentation and lessons learned.

4.0 RESPONSIBILITIES

4.1 Radiological Work Permits

Radiological Control Operations (RCO)	1.	Prepare and approve the RWP (or alternate formal mechanism) per the requirements of the HSRCM-1.
	2.	Ensure that if the RWP (or alternate formal mechanism) estimates meet or exceed any of the established trigger levels that the formal ALARA review process (AMW) is initiated.
Work Control	3.	Ensure that the work document does not proceed in the Job Control System (JCS) until the AMW is completed, as applicable, if the RWP is a part of a JCS work document, per WHC-CM-1-8.

4.2 ALARA Management Worksheet

Cog Engineer	1.	Prepare an AMW for tasks that exceed established trigger levels to identify and prescribe the appropriate controls needed to reduce dose and/or the spread of contamination/radioactive materials to ALARA levels.
	2.	Attach a copy of the AMW to the RWP and include it in the JCS work document before the package proceeds in the system.
	3.	Forward the original AMW to the ALARA POC.
ALARA POC	4.	Copy and distribute as appropriate.

4.3 Pre-Job ALARA Review Record

Work Package Preparer	1.	Ensure a copy of the pre-job brief is included in the JCS work package, as applicable.

Person-in-Charge (PIC)

2. Document the pre-job on the Pre-Job ALARA Review Record prior to starting tasks that require an AMW.

NOTE: All the individuals involved in performance of the field activities shall be present at the pre-job brief or receive an equivalent briefing prior to starting work.

4.4 Conduct of Work in Progress

PIC

1. Conduct periodic field inspections to ensure that the ALARA controls identified in the AMW are implemented and effective.

2. Periodically monitor collective dose accumulation, and compare it with the pre-job dose estimate during the performance of work for which a pre-job dose estimate was made.

4.5 Post Job Review

WCC

1. Forward Work Package, or equivalent, to the ALARA POC to evaluate Post Job Review (Part III) of the AMW.

ALARA POC

2. If the task met any of the criteria established in Post Job Review, initiate a formal radiological post ALARA review. If not, return to Work Control.

3. Forward the original Pre-Job ALARA Review Record to the ALARA Program Office.

4.6 Formal Radiological Post ALARA Review

ALARA POC

1. Notify Cognizant Engineer to perform a formal radiological post ALARA review, as necessary.

Cog Engineer

2. Ensure the post ALARA review addresses the following, as applicable:

   - Compare actual individual and collective dose with the estimates
   - Evaluate effectiveness of ALARA controls
   - Document lessons learned
   - Provide recommendations or ways to reduce dose and minimize contamination for similar activities.

3. Include a copy of the PAR in the JCS work document for the task, if applicable, before closing out the work package.

4. Send a copy of the PAR to the ALARA POC.

5. Send the original PAR to the APO for inclusion into the SHARE database.

5.0 RECORDS

Any records generated as a result of this activity will be handled in accordance with applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance & Support (Champion)	T6-14
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28

7.0 REFERENCES

HSRCM-1, *Hanford Site Radiological Control Manual*, Pacific Northwest Laboratories, Richland, Washington.

WHC-CM-1-8, *Work Management Manual*, Westinghouse Hanford Company, Richland, Washington.

Figure 10-1.

ALARA MANAGEMENT WORKSHEET (AMW)

Work Package No./Procedure	Date	Page 1 of

PART I PRE-JOB	RWP Number	Area/Facility/Location

Job Title/Description of Work:

PART II ALARA REVIEW

Is the collective dose for this task expected to be greater than or equal to 100 person-mrem?
(check one) [] Yes [] No

If Yes, complete section IIA1, IIA2 and IIA3 below. If No, proceed to Part IIB.

PART IIA Estimated Person-Hours	PART IIA1 Individual Dose Estimate mrem	PART IIA2 Prejob Collective Dose Estimate person-mrem

PART IIB Protective Measures / Considerations	Yes	No	Reference/Explanation
A. Are there significant exposure levels which would warrant moving the task, as applicable, to an area of lesser dose consequence?			
B. If the item or system(s) is contaminated, would it be practical and/or beneficial to decontaminate?			
C. Will temporary shielding be used to lessen external personnel dose?			
D. Are there lessons learned from similar tasks that could be reviewed at the pre-job meeting?			
E. Will mock-ups or dry-runs be utilized prior to initiating task?			
F. Will this task employ the use of temporary containment structures and/or ventilation systems?			
G. Are there specific hazards, condition changes, or other variables that will affect this task?			
H. Will waste be generated which requires input and/or support from HMC?			
I. Are there variables which require the use of alternate evacuation routes or will delay response to emergency signals?			
J. Are there formal Radiological Control Hold Points associated with this task?			
K. Will grab sampling (radiological) or CAMs be utilized?			

PART IIC Corrected Person-Hour Estimate (if PART IIA completed)	PART IIC1 Corrected Individual Dose Estimate (If PART IIA1 completed)	PART IIC2 Corrected Prejob Collective Dose Estimate (If PART IIA2 completed)
_____Hours	_____mrem	_____person-mrem

PART III POST JOB REVIEW

Did any of the following occur as a result of this task? (Check one) [] Yes [] No

- An actual collective dose equivalent of 5 person-rem or greater
- Actual doses for a task outside the range of ±25% of pre-job estimates, as applicable
- Use of the stop radiological work authority
- A task results in a reportable radiological occurrence per DOE 5000.3B reporting criteria
- For identification of significant lessons learned.

If Yes, initiate a formal radiological post ALARA review. If No, there is no further review required.

ALARA Point-of-Contact: Mark D Nuzum Date:_____/_____/_____

AMW Preparer	Date:_____/_____/_____

DISTRIBUTION: Original - Radiological Control Records Office
Copies - ALARA Program Office / Work Package / Facility ALARA Point-of-Contact

Figure 10-2.

POST ALARA REVIEW

Work Package/Procedure	RWP No.	Area	Facility	Specific Job Location

Job Title	Job Description

Describe any modifications made to the original work plan to increase, decrease, or change the following:

1. Dosimetry
2. Respiratory Protection
3. Protective Clothing
4. Time/Distance/Shielding
5. Personnel

Evaluate the effectiveness of the ALARA controls that were implemented. List dose reduction savings, decontamination factors achieved, and installed engineering applications which attributed to reduction.

Compare the "actual" person-hours and person-rem to "estimates." List reasons for person-hour/person-rem that is + or - 25% of the prejob estimate.

Describe any deviations from the original scope including any planned ALARA controls that were not implemented and the reasons.

Describe any situations encountered during the job, especially those that caused stoppages.

List Lessons Learned and Corrective Actions taken to prevent recurrence.

Estimated Prejob Collective Dose	Actual (Postjob) Collective Dose	Corrected Dose Savings/Difference
person-mrem	person-mrem	person-mrem

Identify the person performing the Post ALARA Review

COG/PIC	Date
Other	Date

Distribution: Original - ALARA Program Office Copy - Work Package Copy - Facility ALARA Committee Chair

Figure 10-3.

PRE-JOB ALARA REVIEW RECORD		
Work Package No./ Procedure	RWP No.	Date:_____/_____/_____
Job Title		

Topics for Discussion (check-off as discussed)			
	A. Review of AMW, Part IIB, Protective Measures / Considerations.		D. Review of Internal/External Dosimetry Requirements (RWP).
	B. Review of estimated dose rates (RWP).		E. Review of Protective Clothing Requirements (RWP).
	C. Review of maximum contamination levels (RWP).		F. Review of the Special Instructions Section in the RWP.

Attendance Roster	

Pre-job Chaired By	ALARA POC Mark Nuzum 373-5966

Distribution:

Original - ALARA Program Office
Copies - Work Package / ALARA POC

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ALARA Program Records

Approved by
A. G. King, Manager
Analytical Services
12/22/95

1.0 PURPOSE

This section contains requirements for maintaining records relating to the ALARA process, which are a part of the WHC ALARA Program. The work force and management are required to use records to document the use and implementation of the ALARA process onsite. The records necessary to demonstrate compliance with, and the adequacy of, implementing federal and WHC ALARA Program requirements are included in this section.

2.0 SCOPE

This section defines the records and record retention requirements for the facility and sitewide WHC ALARA Program documentation.

3.0 DEFINITIONS

See applicable sections of this manual for the definitions of the records listed.

4.0 RESPONSIBILITIES

4.1 ALARA Records

Records that should be maintained to demonstrate compliance with, and the adequacy of, implementation of federal and management requirements are listed below.

1. ALARA Management Worksheets (Figure 11.10-1)
   Original - Radiological Control Organization
   Duplicate copies - ALARA Program Office, Facility ALARA POC, work package (as applicable).

2. Post ALARA Review (Macro WEF192, Figure 11.10-2)
   Original - ALARA Program Office
   Duplicate copies - work packages, Facility ALARA POC

3. Pre-job ALARA Review Record (Figure 11.10-3)
   Original - ALARA Program Office
   Duplicate copies - work packages, Facility ALARA POC

4. ALARA Checklist (Macro WEF042, Figure 11.9-2)
   Original - ALARA Program Office
   Duplicate copies - work packages, Facility ALARA POC

5. ALARA Exposure Tracking and Management System Investigations
   Original - ALARA Program Office

6. ALARA Performance Goals - See Section 4.0
   Annual and quarterly status

7. RADCON Meeting Minutes
   Original - RADCON Team Chair
   Duplicate copy - ALARA Program Office

8. Cost/Benefit Analysis - See Section 8.0
   Original - ALARA Program Office
   Duplicate copies - work package, Facility ALARA POC

9. Internal ALARA Reviews and ALARA Work Practice Assessments (See Section 7.0)
   Original - Auditing Organization
   Duplicate copy - ALARA Program Office, Facility ALARA POC

5.0 RECORDS

Any records generated as a result of this activity will be handled in accordance with applicable Records Inventory and Disposition Schedules.

6.0 DESIGNATED REVIEWERS

Designated Reviewing Organizations	CMPOC
Operations Assurance & Support	T6-14
HASQAP Compliance	T6-16
222-S Analytical Operations	T6-16
WSCF Analytical Operations	S3-28